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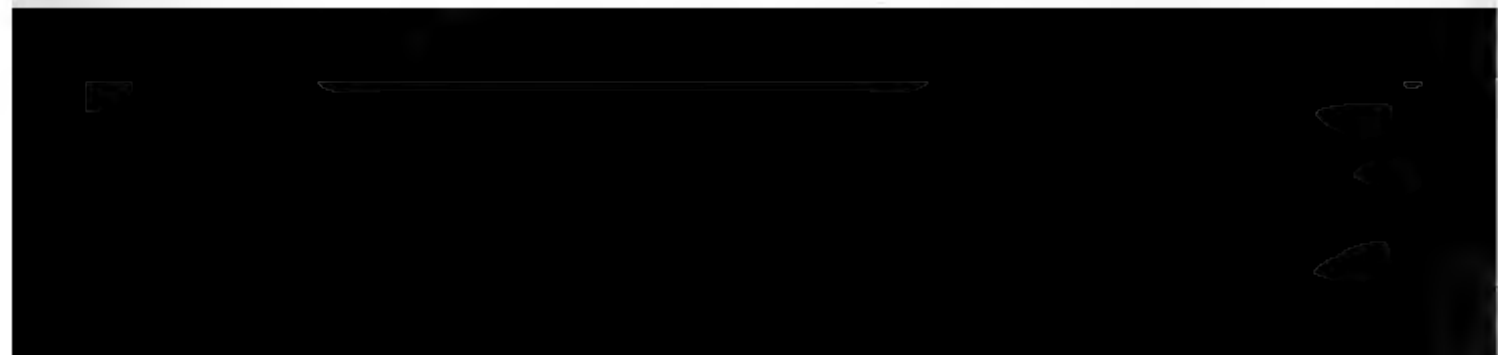
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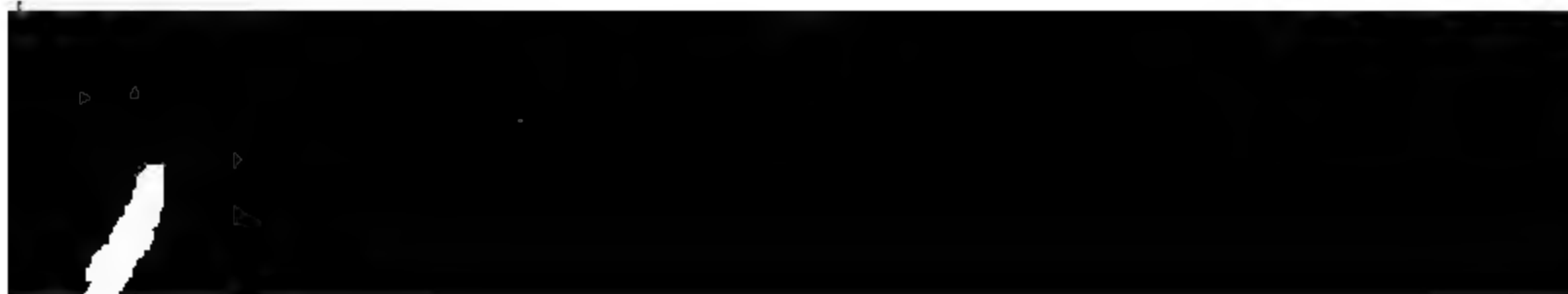
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78th CONGRESS }
1st Session }

SENATE

{ DOCUMENT
No. 55 }

ANNUAL REPORT OF THE

ISTHMIAN CANAL

COMMISSION

FOR THE FISCAL YEAR ENDED JUNE 30

1907

DECEMBER 5, 1907.—Read: referred to the
Committee on Interoceanic Canals
and ordered to be printed



WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

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To the Senate and House of Representatives:

In accordance with the provisions of "An act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June 28, 1902, I transmit herewith the Annual Report of the Isthmian Canal Commission for the fiscal year ended June 30, 1907.

THEODORE ROOSEVELT.

THE WHITE HOUSE, *December 5, 1907.*

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ANNUAL REPORT OF THE ISTHMIAN CANAL COMMISSION.

CULEBRA, CANAL ZONE, *October 17, 1907.*

SIR: I have the honor to submit, on behalf of the Isthmian Canal Commission, its annual report for the fiscal year ending June 30, 1907.

ORGANIZATION OF THE COMMISSION.

At the close of the previous fiscal year the Commission consisted of six members. During the present fiscal year the entire personnel was changed, brought about by the transfer of Governor Charles E. Magoon, on September 25, to administer affairs in Cuba, by the acceptance of the resignations of Mr. Theo. P. Shonts, chairman, effective March 4, 1907; of Gen. Peter C. Hains, Maj. B. M. Harrod, and Rear-Admiral Mordecai T. Endicott, effective March 16, 1907, and, finally, of Mr. John F. Stevens, chairman and chief engineer, on April 1. To the vacancies thus created were assigned three officers of the Corps of Engineers, United States Army; the Chief of Bureau of Yards and Docks, United States Navy; an officer of the Medical Corps, United States Army, and two civilians. The two important changes resulted from a combination of the positions of chairman and chief engineer on March 4, and from the requirement that the Commissioners take station on the Isthmus, where they can be in direct touch with the work committed to their charge. The new Commission assumed its duties on April 1, 1907. Of the departments created by Executive order of November 17, 1906, three were then established on the Isthmus—department of construction and engineering, department of labor and quarters, and the department of sanitation. The department of law and government was under the general counsel in Washington, but was subsequently subdivided and the civil government transferred to the Isthmus.

CONSTRUCTION AND ENGINEERING.

In order to utilize the services of the engineer members of the Commission in construction work and to secure a closer supervision of the details of the work, then rapidly expanding, through a head directly responsible to the chairman and chief engineer, the department of construction and engineering was subdivided into departments, each in charge of a member of the Commission, as follows: Department of excavation and dredging, department of lock and dam construction, department of municipal engineering, motive power and machinery, and building construction.

EXCAVATION AND DREDGING.

This department of construction embraces the Culebra division, extending from the Chagres River to Pedro Miguel, the Chagres division, embraced between deep water in Lake Gatun and the Chagres River, the Colon dredging division, extending from Gatun to deep water in the Atlantic, and the La Boca dredging division, taking in all excavation between the La Boca locks and deep water of the Pacific.

Culebra division.—The last annual report of the Commission, dated December 6, 1906, states that:

During the year the first stage of canal work, that of preparation, has virtually been passed and the Commission finds itself in position to enter upon the second stage, that of actual construction of a lock canal at an elevation of 85 feet, authorized by Congress in June last.

This statement is peculiarly applicable to the Culebra division, on which efforts had been concentrated, for, irrespective of the type of canal to be constructed, the excavation in this section of the territory had to be done. Moreover, for the time being it was the most important part of the work. That the preparation was efficiently done and the organization effective is best attested by the results accomplished and the relatively small falling off of the output during the wet months; thus the amount of material removed from the Culebra cut was 4,047,071 cubic yards, place measurement, from January 1 to June 30, out of a total of 5,570,432 cubic yards for the fiscal year.

The Culebra division is practically 10 miles in length, and early in the wet season it was recognized that general supervision of all the steam shovels or all the trains of the entire division under one supervisor or superintendent was not productive of the best results in fixing responsibility in case any part of the work was not progressing satisfactorily, consequently a slight change in organization was effected on July 1. This consisted in subdividing the division into five construction districts, each under charge of a superintendent of construction, who is held responsible for the work in his district.

Better results have followed with less friction. Since the close of the fiscal year the monthly output improved over the early months of the wet season, as indicated by the following table:

Month	Number of working days	Daily average number of shovels at work	Output
1907			
July	26	43.38	770,570
August	27	39.70	741,868
September	24	38.50	753,468

The work of this division is dependent on mining, steam shovels, transportation, and dumps, and as these matters are described in detail in Appendix A, further reference here is unnecessary. It might be stated, however, that the greatest difficulty found in maintaining the output thus far during the rainy season is due to the dumps; the material being loose sinks under train loads after being wetted by the heavy rains, causing considerable delay if not entirely preventing the use of the dump until it has dried out.

During the year surveys were made with the view to preventing water from adjacent watersheds entering the canal. The French partially constructed a diversion channel for the Obispo River; plans have been approved for carrying this and other waters into the Chagres River about a mile above the point where the canal crosses the river, through a channel to be constructed to the east of the canal.

Chagres division.—On this division only preparatory work was done during the year, consisting of surveys and borings to determine the character and amount of earth to be removed. The Chagres River crosses the center line of the canal twenty-three times within the limits of the division. The differences of level between the river and portions of the division are such that whatever excavation in the dry is undertaken will be subject to more or less interruption from overflow during the wet season. As the rock portion of the cut can be removed or broken up by blasting more economically in the dry than in the wet, it is desirable that work be undertaken without delay; though the amount to be done is relatively not large, the conditions are such as to militate against rapid progress.

Since the close of the fiscal year work has been commenced and steam shovels diverted from Culebra division until others under contract are delivered.

Colon dredging division.—This division consists of the Mindi and Colon districts. In the former about 700,000 cubic yards of material in the vicinity of Mindi Hills will be removed by steam shovels, this method being more economical since the borings made during the fiscal year indicate that a large percentage of rock is found in this locality; the remainder will be dredged. The necessary clear-

ing and other preparations were made and excavation by steam shovel was begun toward the close of the year.

In the Colon district dredging operations were in progress throughout the year, the greater part in the vicinity of the dry dock slip and along the route of the old French canal as far as Gatun. The latter was done to make a navigable waterway for the transportation of the materials that must be taken to the site for the construction of the locks. The dredging fleet consisted of one old French ladder dredge, one 5-yard dipper dredge, and one 16-inch suction dredge; and there were under contract another dipper dredge and a seagoing suction dredge similar to those now operating in New York Harbor. For use in connection with this fleet six steel hopper barges were under contract. During the year the dredges in use were served by a tug and four old French self-propelling dump barges, known as "Clapets."

The excavation by dredges during the fiscal year amounted to 1,112,321 cubic yards, place measurement, of which 43,802 cubic yards were rock; 17,000 cubic yards of the total were removed from the canal prism, the remainder of material being from accessory works.

The machine shop for the Colon dredging division at Cristobal was equipped during the fiscal year with many pieces of new machinery and is in good working order. Steps were taken to enlarge the dry dock so that when completed it will be capable of taking a vessel 298 feet long, 50 feet beam, and 15 feet draft.

La Boca dredging division.—The surveys in progress during the previous fiscal year to determine the line of the canal were continued and completed. Test borings were made in the channel west of Naos Island to a depth 40 feet below the low water of spring tide to ascertain the character of material to be removed. The dredging fleet for this division consisted of one old French ladder dredge and one 5-yard dipper dredge. A second French ladder dredge was undergoing repairs and was put in operation after the close of the fiscal year. A seagoing dredge similar in type to the suction dredge for the Colon end is under contract and when finished will proceed under its own steam by way of Cape Horn to Panama. The ladder dredges and dipper dredges were served by seven French self-propelling dump barges, and a contract was made for three steel hopper barges to be used for the same purpose.

During the past fiscal year 1,235,897 cubic yards of material were dredged from the division, of which 64,352 cubic yards were taken from the canal prism and the remainder from accessory works.

The machine shop at La Boca is fairly well equipped for marine work and has accomplished much in rebuilding and repairing floating equipment, such as clapets, launches, barges, and electric cranes.

For further details relating to the department of excavation and dredging, attention is invited to Appendix A.

LOCKS AND DAMS.

This department of construction embraces the Gatun locks and dam, the locks and dam at Pedro Miguel, the locks and dams at La Boca, meteorology and river hydraulics.

The locks are in pairs, each, as now proposed, with usable lengths of 1,000 feet and widths of 100 feet. The adopted project contemplates a flight of three locks at Gatun, a flight of two at La Boca, and one lift at Pedro Miguel.

Prior and subsequent to the adoption by Congress of the 85-foot level canal in June, 1906, borings were made to determine the character of the foundations at the various lock sites. The classification of the data so obtained was recorded in such a way as to cause considerable adverse comment, questioning the suitability of the material for the purpose. To actually develop the character of the foundations on which the locks are to rest five test pits each 6 feet by 8 feet were sunk to the depths of the lock walls at Gatun, two at Pedro Miguel, and one at the spillway in Gatun dam. The outcropping of trap rock at La Boca, which borings showed extends to proper depths, rendered such examinations of the foundations for these locks unnecessary. On the completion of the test pits a Board of Consulting Engineers, consisting of Alfred Noble, Frederick P. Stearns, and John R. Freeman, made a personal examination of the material, and under date of May 2, 1907, reported as follows:

We beg to record that we found that all of the locks of the dimensions now proposed will rest upon rock of such a character that should furnish a safe and stable foundation.

Since then careful borings have been continued over the entire area in order to secure a contoured plat of the rock surface with a view to the most economical adjustment of the locks to the site.

Subsequent to the adoption of the project, studies were begun of locks, gates, and sluiceways. From these studies the Commission finally decided upon the method of filling and emptying the locks and the number and type of gates. The gates are in duplicate and of the miter type, except that the rolling gate similar to that now in use on the Ohio River will be substituted for the duplicate set at the lower end of each summit-level lock. In addition there will be provided an auxiliary pair of gates at the lower end of each flight for use as cofferdams in case it may be necessary to pump out the locks, and it has been determined tentatively to adopt a swing-bridge type of dam for emergency use. The designs for the locks and gates are progressing satisfactorily.

Gatun locks and dam.—Excavation of the lock site by steam shovels was begun in September, and by the end of March four shovels were at work, and a total of 484,362 cubic yards, place measurement, of earth and rock were removed during the year.

About 573 acres of the site to be occupied by the dam were cleared of timber, and a pile trestle was partially driven along the 30-foot contour on the upstream toe of the dam for the purpose of depositing rock from Bas Obispo as an integral part of the dam. Contracts were entered into for two 20-inch pipe line suction dredges for construction use on the lower portion of the dam.

The cross section of the dam has been slightly changed and the upstream slope made more gradual than that originally proposed, as will be seen by an examination of the profile which accompanies Appendix B of this report.

The report of the Board of Consulting Engineers advocating the lock canal project provides for the construction of a spillway through the dam. The work of excavation was commenced in April, and one steam shovel was placed at work; 3,832 cubic yards, place measurement, were removed and dumped in the near vicinity.

A topographical survey was made of the basin of the lake up to the 100-foot contour, and all the saddles in the hills were carefully examined to ascertain the nature of the material composing them. The survey was practically completed at the close of the fiscal year, from which the area of the lake is determined to be 164.23 square miles.

Broken stone needed for concrete construction in the locks can not be obtained in the immediate vicinity of the site and a quarry of trap rock suitable for the purpose was located at Porto Bello. Surveys of the property were made, and contracts were entered into for furnishing the necessary rock-crushing plant and barges for transporting the product to Gatun.

Pedro Miguel locks and dam.—Besides the pits already noted and numerous borings made to determine the character of the foundations, work was confined to excavating the lock site, and 162,094 cubic yards, place measurement, were removed. This excavation was done by the Culebra division in connection with the work at Culebra cut, and is noted as part of that output.

La Boca locks and dams.—During the fiscal year only preparatory work was in progress and consisted of borings at the lock site and along the lines of the two dams, La Boca-San Juan dam and the Sosa-Corozal dam, and for locating and constructing the necessary spillway. At the Sosa-Corozal dam preparations were made for the construction of trestles on the two toes of the dam from which material from Culebra cut is to be dumped. Between the two dumps thus made suitable material for the dam is to be placed. Arrange-

ments were made for the construction of a diversion channel for drawing off water which interferes with the construction of the dam so begun.

A survey was in progress for determining the area of the property that will be submerged by the lake that the construction of the two dams will create.

Meteorology.—Three meteorological stations were in operation at the end of the year—Naos Island, Ancon, and Bas Obispo—and a fourth station was begun at Cristobal.

River hydraulics.—This division of the work has for its object the collection of data necessary to predict freshets in time to take precautions for the preservation of property, and also for the determination of the amount of water that can be relied upon for supplying the lakes that will exist upon the completion of the canal.

At Alhajuela, rain-gauge and fluviograph observations were made from October 13, 1906, to the end of the fiscal year. Similar observations were made at Gamboa and Bohio during the entire year, but not until April were any gaugings of the Trinidad and Gatuncillo rivers started, when arrangements were made for discharge measurements of the several channels at Gatun.

For further details of the work of this department of construction attention is invited to Appendix B.

MUNICIPAL ENGINEERING, MOTIVE POWER AND MACHINERY, AND BUILDING CONSTRUCTION.

Division of municipal engineering.—The work performed by this division during the fiscal year included the paving of streets and construction of waterworks and sewer systems in the cities of Panama and Colon, paving, roadmaking, grading, construction of waterworks and sewer systems, and miscellaneous work of a similar nature in the Canal Zone, necessitating an expenditure of \$1,741,953, divided about equally between work in the cities of Colon and Panama and work in the Canal Zone.

In general, the work has been but a continuation of the plan inaugurated at the outset of American occupation of the Isthmus—to take such steps as were necessary to make the Isthmus sanitary, so as to further the work of building the canal.

The cost of work done in the cities of Colon and Panama will be reimbursed to the United States under the terms of contracts entered into shortly after the expiration of the fiscal year, in which the United States is authorized to collect such water rates as are sufficient to reimburse itself, as above outlined. The cost of these improvements in the cities of Colon and Panama, covering work approved to date, will approximate \$1,750,000.

In Panama 13,000 feet of water pipe were laid, consisting mainly of extensions in outlying districts. The waterworks system in Panama proper is practically complete. Connections were made to 2,093 houses, 1,048 meters installed, 133 hydrants, 7 water cranes, and 35 public taps placed. The average consumption of water per capita is about 20 gallons per day. The quality of water, as regards freedom from bacteria causing disease, is excellent.

Sewer pipe to the amount of 12,232 feet was placed, 2,096 storm sewers built, 46 manholes and 62 catch-basins constructed, and two large storm-water sewers were built for special drainage purposes.

On April 3, 1907, all brick paving in the city was completed. Streets were made of sufficient width to permit the passage of two teams. This work included 21,725 cubic yards of grading, 9,056 square yards of concrete foundation, and 29,066 linear feet of curb. In the brick paving work 1,922,297 bricks were used, requiring 16,565 square yards of macadam foundation. Two thousand seven hundred and forty-six square yards of macadam paving and 19,088 square yards of concrete paving were laid.

In Colon the waterworks system is practically complete. During the fiscal year 3,956 feet of water pipe were laid, 75 house connections made, 414 service boxes installed, and 122 meters tested and set.

The sewerage system was completed, and in this work 24,521 feet of sewer pipe were used. On cross drains, 1,377 feet of sewer pipe were laid. Excavation amounting to 16,300 cubic yards was made and 62 manholes built. A sump was constructed during the year, into which all sewage flows. The completion of house connections with this system and the installation of modern plumbing was in active progress at the end of the year.

Paving in Colon included 2,500 square yards of excavation, 9,031 square yards of brick pavement, 3,211 linear feet of curb, and 2,910 feet of headers for brick pavement curb. On the streets of Colon the following work was done: Thirty-six thousand nine hundred and ninety-three linear feet combination curb and gutter, 43,104 square yards of macadam, 15,253 cubic yards of earth fill, 2,218 cubic yards of grading, 15,500 linear feet of excavation for curb trench, and 7,965 linear feet of concrete header.

For surface drainage, a 16-inch galvanized-iron pipe was laid on Eleventh street, from Bolivar street to the beach, and on Fifth, Seventh, and Ninth streets, from Front street to the beach. In addition, 1,795 linear feet of vitrified pipe were laid in macadamized streets.

In Ancon and vicinity, 23,733 feet of road were constructed. A filtration plant, with a capacity of 1,500,000 gallons per day, a pumping system, and a boiler plant consisting of two 125-horsepower boilers were added to the waterworks system. Eighteen thousand

PLATE 1



VIEW OF CAMPUS FROM RESERVOIR. SHOWING ADMINISTRATION BUILDING ON LEFT, HOTEL ON RIGHT, AND Y.M.C.A. CLUB HOUSE IN CENTER



PLATE 2.





PLATE 3



COMACHO RESERVOIR





SPILLWAY AND DAM COMALMO RESERVOIR



four hundred and twenty-six feet of water pipe were laid, together with 1,130 feet of pipe for steam lines. Fifty-six houses were connected, 11 hydrants placed, and 34 hose valves located. Ten thousand two hundred and ninety-five feet of sewer pipe were laid, 52 houses connected, and 38 manholes built.

In La Boca 3,839 feet of water pipe were laid, 6 houses connected, and 45 hose valves placed. One hundred and eighty feet of sewer pipe were also laid, to which two house connections were made.

At Corozal 1,646 feet of water pipe were laid, 10 house connections made, and three hose valves placed. One thousand seven hundred and forty-four feet of sewer pipe were placed, 6 house connections made, and 8 manholes constructed.

At Pedro Miguel 3,118 feet of water pipe were added to the system, 35 houses were connected, and 8 hose valves placed. Four thousand eight hundred and eighteen feet of sewer pipe were laid, 33 house connections established, and 15 manholes built. About 500 feet of road grading were done.

At Paraiso a 15,000-gallon tank was installed in connection with the water system. Five thousand two hundred and six feet of water pipe were laid, 36 houses connected, 10 hydrants located, and 4 hose valves placed. Eight thousand four hundred and seventeen feet of sewer pipe were laid, 54 houses connected, and 33 manholes built.

A 16-inch Venturi meter was installed in January for measuring water consumption from Rio Grande reservoir, which has an available capacity of 248,230,000 gallons. Changes are under way which will increase the storage capacity by about 75,000,000 gallons. The stone-crusher plant, which was moved to Rio Grande from Pedro Miguel, was enlarged by the addition of two No. 5 crushers. The total output was 49,512 cubic yards.

At Culebra a pumping station, with a daily capacity of 160,000 gallons, was built, and a distilling plant was placed in operation, supplying distilled water to Culebra and Rio Grande. Five thousand nine hundred and thirty-two linear feet of water pipe were added, 103 houses connected, 18 standpipes constructed, and 12 hydrants placed. Eleven thousand five hundred and eighty-three feet of sewer pipe were laid and 91 houses connected. Six thousand three hundred and eighty-five linear feet of roads and paths were constructed.

The reservoir at Camacho, having an available capacity of 258,000,000 gallons, was completed and will be ready for use at the end of the present rainy season. In Camacho and Empire 20,702 feet of water pipe were laid, 22 standpipes constructed, 10 fire hydrants placed, and 71 houses connected. Nineteen thousand two hundred and twenty-five feet of sewer pipe were placed and 3,946 feet of macadam road constructed.

At Las Cascadas a complete system of 10-inch mains was constructed. In May, the sterilizer was replaced by a standard condensing plant, supplied by steam from the air-compressor plant. Three thousand one hundred and thirty feet of road were built.

At Bas Obispo, Chagrescito, Santa Cruz, and other places along the line of the canal, minor additions and changes were made in connection with the water supplies, as follows: Fifty-one thousand and twenty-three feet of water pipe were laid; 32,541 feet of sewer pipe placed; 834 houses connected; 109 hose connections established, and 66 water faucets, 24 fire hydrants, 12 tanks, 6 water columns, and 2 standpipes placed.

At Gorgona the storage capacity of the Carabali dam was increased from 40,000,000 to 85,000,000 gallons. A condensing plant was placed in operation with the pumping station. At the machine shops a complete inside fire system was installed and placed in operation. A complete system of sewers for the shops was built. In Gorgona 7,600 feet of road were constructed.

At Tabernilla a new system of water service was installed as well as a sewer system, both of which are practically complete.

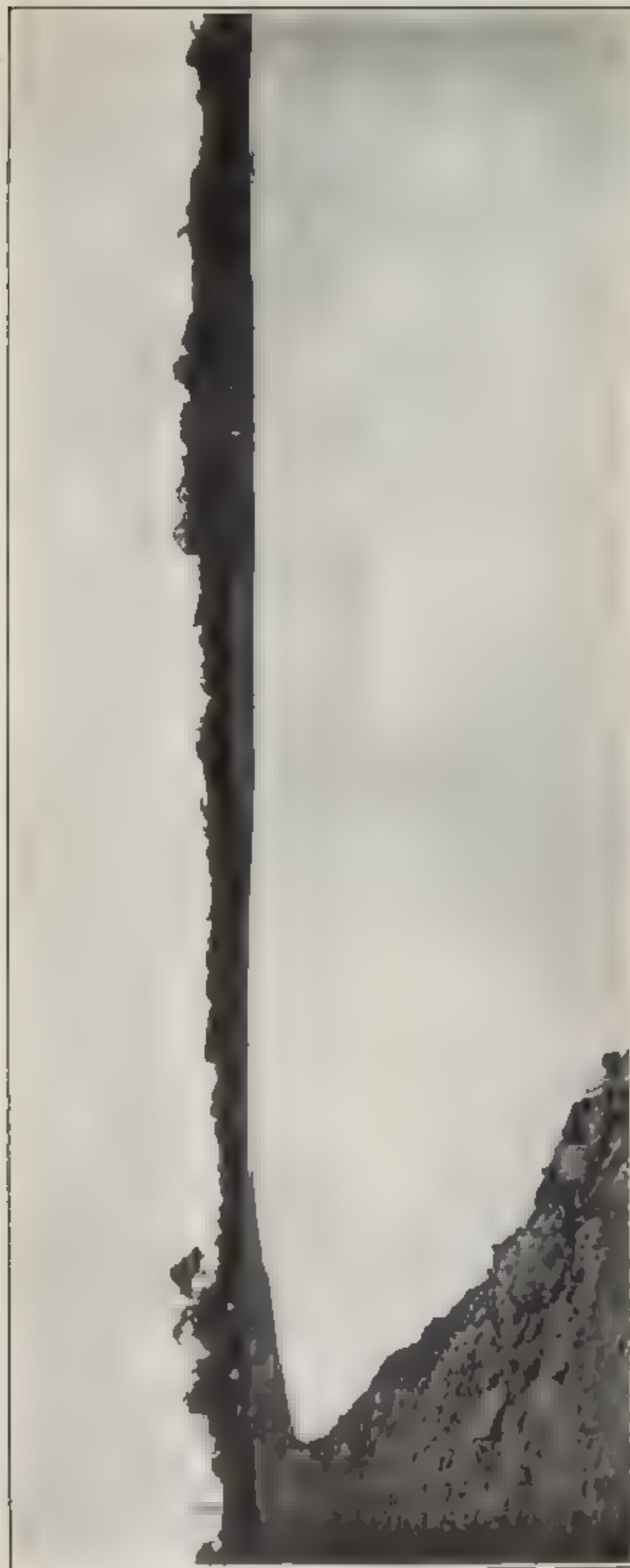
At Gatun a 5-inch galvanized-iron main was laid throughout the town, connecting all white quarters. A permanent distilling plant was erected and fire-protection system installed. Nine thousand two hundred feet of road were built.

At Bas Obispo 3,886 feet of road were built.

Cristobal and Colon are supplied from the Mount Hope reservoir, which was completed in December, 1906, and has a capacity of 435,000,000 gallons. Seven meters were installed for measuring water consumption. During the year two pumps and two 80-horsepower boilers were installed at the Mount Hope pumping station. A filtration plant was built and started operating in July. Five and one-half miles of gravel road and paths and 2 concrete bridges were constructed at the Mount Hope Cemetery. The Mount Hope road, connecting Mount Hope and Cristobal, is nearing completion.

At Cristobal the water system was extended to dock 11, the ice plant, bakery, and laundry. Four-inch connections were made to supply Clapets with water, 42 houses connected, and 26 fire hydrants placed. A 6-inch main was laid from the Mindi pumping station to the Cristobal machine shops. The 5,129 feet of sewer pipe laid furnished connections to Camp Bierd, the machine shops, and the market. Six thousand nine hundred and fifty-three cubic yards of grading, 3,200 cubic yards of earth fill, 23,463 square yards of macadam spread, and 20,187 linear feet of concrete curb and gutter were done on road work in Cristobal. Nine hundred feet of open drains and 12 catch-basins were constructed. One hundred and fourteen fire plugs were placed in Cristobal and Colon.

PLATE 5.



MOUNT HOPE RESERVOIR



The labor supply has been ample to meet demands at all times. The average daily force carried during the year was 2,593 employees, both gold and silver.

Division of motive power and machinery.—The work of this division embraced the erection and preparation for service of machinery necessary in canal construction and its maintenance in good repair; the installation and operation of air-compressor plants; the performance of work in connection with electrical installations, and the manufacture and repair work for other divisions. During the year 2,479 employees were carried on the rolls and expenditures made to the amount of \$6,360,496.56.

To date the following machinery has been erected and made ready for service: Sixty-three steam shovels, 284 locomotives, 2,706 dump cars, 18 unloaders, 13 bank spreaders, 33 unloading plows, 3 track shifters, and 7 pile drivers.

This work has been done largely at the old plants at Cristobal, Gorgona, Empire, and Paraiso. Work was commenced on new plants at Empire and Paraiso during the year, in order to provide for increased demands made on this division. In addition, limited facilities for handling equipment and making running repairs are being provided at Pedro Miguel, Rio Grande, and Tabernilla.

Engine houses for taking care of engines during the night and making running repairs were provided at Lirio, Cucuracha, Las Cascadas, and Rio Grande.

Coal chutes for delivering coal to locomotives, and which also have appliances for drying and delivering sand to locomotives, are located at Las Cascadas and Pedro Miguel.

Air compressor plants were located at Rio Grande and Empire, furnishing compressed air to operate rock drills, stone crushers, etc. Nine and one half miles of 10-inch pipe-line mains, with 6-inch and 4-inch leads running into the canal prism, were laid, extending from Bas Obispo to Pedro Miguel. These plants also supply compressed air for operating coal chutes at Pedro Miguel and Las Cascadas, as well as such compressed air as is needed at the Empire and Paraiso shops.

A thorough boiler-inspection service was established, covering all boilers on the Isthmus, including the Panama Railroad. The jurisdiction of the mechanical engineer, master car builder, and electrical engineer has been extended to cover the Panama Railroad.

The principal work of the electrical subdivision was the construction of electric-lighting plants at Empire and Gorgona. The plant at Empire has a capacity of approximately 4,000 16-candlepower lights. About 10 miles of pole line were constructed in connection with this plant, which now supplies light to practically all build-

ings at Culebra, Empire, Rio Grande, Enterprise, Cerro, and Lirio, and extensions to Las Cascadas and Paraiso are now under way.

The Gorgona plant was placed in operation in May and has a capacity of about 2,000 16-candlepower lights. Three miles of pole line were connected with this plant, and light is furnished from it to buildings at Gorgona and Matachin, including the Gorgona shops.

Considerable work of a minor character was done, including automatic fire-alarm telegraph systems, the construction of arc-lamp circuits at different points, and other miscellaneous work.

Building construction division.—The work of this division consisted in the construction of buildings for the different departments and divisions of the Commission.

For the accommodation of gold employees 656 quarters, both bachelor and family, were constructed, and for silver employees 335 buildings were erected, consisting of barracks, bath houses, cook sheds, family quarters, and kitchens. For the sanitary department 33 buildings were constructed for hospital purposes. Larger office buildings were constructed at Empire and Ancon and additional office space afforded at Cristobal and Culebra. A school building was constructed at Culebra, and other buildings for similar purposes started at Gatun, Cristobal, and Empire. Seven mess halls for the accommodation of American employees and 11 for European laborers were completed; a large hotel at Tivoli Hill was also built, together with quarters for help and baggage room. A machine and car-repair shed, machine shop, engine house, pattern shop, and other structures for the manufacture and repair of machinery, to the number of 10, were completed and extensive plants at Paraiso and Empire were commenced. Four commissaries, sanitary storehouses, and 1 corral were completed, together with coal chutes at Las Cascadas and Pedro Miguel, and division office buildings at Gatun and Ancon. Four clubhouses were constructed, 1 each at Culebra, Empire, Gorgona, and Cristobal.

Manufacturing plants were operated at Ancon and Lirio. At the latter plant additions were made to enlarge its capacity and it is now running on full time and turning out work rapidly. The amount expended during the year on manufacturing was \$276,884.19.

Of the 2,265 buildings which were received from the French Canal Company, 252 were repaired during the year and 113 destroyed. There are 678 of these buildings yet remaining to be repaired, remodeled, or demolished.

A total of 767 new buildings were constructed covered by this report, and on June 30, 1907, there were on hand 2,919 buildings of all classes. Six buildings were started at Porto Bello, about 18 miles from Cristobal, for occupancy as quarters by forces engaged in stone-crusher work at that point, the product to be used for concrete in lock

PLATE 6.



DAM NO 2 MOUNT HOPE RESERVOIR



construction. Fire department buildings, jails, churches, post-offices, and fumigation houses to the number of 27 were constructed along the line.

The average force employed was 3,570 men, and in the work outlined above \$4,357,587.57 were spent. The largest single item of expenditures was for quarters for gold employees, amounting to \$1,432,415.51. The next largest item was for construction of silver employees' quarters, amounting to \$482,502.88. For the construction of buildings for hospital purposes there were expended \$315,196.57 and for supervision and clerical force \$193,763.73. These figures for construction work include both labor and material.

There were prepared in the architect's office 145 finished sets of drawings, consisting of 605 sheets of tracings and bills of material for most of these sets.

Further details in connection with the work of this department of construction are given in Appendix C.

DIVISION OF MATERIAL AND SUPPLIES.

The division of material and supplies, the head of which reports directly to the chief engineer, is charged with the purchase and the proper handling of all material and equipment needed in connection with the construction of the canal. The diversity of the work necessitates the purchase and use of a very great variety of equipment, material, and supplies, including stock for repairs. All departments on the Isthmus rely upon this division to supply their various wants, and every effort is made to anticipate requirements by frequent purchases in the United States, based on estimates submitted by the different divisions or gauged by the rate of consumption of stock on hand at the various storehouses along the line.

During the year material was received by purchase to the value of \$9,500,000, of which over 90 per cent covers purchases made in the United States. This has entailed the handling of 37 full cargoes of material and partial cargoes from about 150 vessels. Among other items there were 23,000,000 feet of lumber, 254,000 cross-ties, 4,000 piles, and about 50,000 tons of miscellaneous cargo. All material, except lumber, piling, ties, rail, and rolling stock, is received and checked at the Mount Hope storehouse, from which distribution is made to the several storehouses along the line. A large amount of old French material, consisting of boilers, pumps, Decauville track, cars, locomotives, cranes, and other material, has been repaired and placed in service. About 11,000 tons of this old French material were disposed of to dealers in the United States as scrap iron, and 4,000 tons of it were used as ballast by Panama Railroad vessels going north, when there was a shortage of commercial cargo.

Storehouses for the distribution of this material are located at Mount Hope (general storehouse), the dry dock, Cristobal, Gorgona,

Bas Obispo, Empire, Culebra, Paraiso, Ancon, and La Boca. Larger and more commodious storehouses are under construction at Empire and Paraiso. All storehouses carry as full a line of supplies as is carried at the general storehouse.

On April 1 damage by fire was caused to the general storehouse at Mount Hope to the extent of \$100,000. This occasioned no delay in the work. The building has been rebuilt in three sections, with fire walls extending from the ground to the roof, thus minimizing the possibility of loss by fire in the future.

In addition to the work of handling all supplies for the Commission this division is charged with the care and operation of corrals and equipment used in land transportation on the Isthmus. Corrals are located at Cristobal, Gatun, Tabernilla, Gorgona, Bas Obispo, Las Cascadas, Empire, Culebra, Paraiso, Corozal, Ancon, and La Boca. Over 600 horses and mules, with the necessary wagons, carts, carriages, and ambulances, are in this service. In this connection it is interesting to note that the cost per month per team to the Commission for teams actually working, including all charges for labor, forage, and miscellaneous items, as well as expense of sick teams, was about \$110. A proposal was received recently by the Commission from a contractor in the United States, who has had considerable experience in similar work in Central America, to do all land transportation at the rate of \$450 per month per team, or over four times what it is costing the Commission at the present time.

A printing plant, which handles all the stationery and printing required by the various departments on the Isthmus, is also operated by this division.

The organization of this division was changed early in the fiscal year in such a way as to secure the greatest efficiency of force with the maximum results. Twelve hundred and eighty-nine employees were carried on its rolls, and expenditures on account of its operation amounted to \$755,321.89, which was considerably less than the estimate submitted prior to the beginning of the year.

Further details as to the work of this division are given in Appendix D.

CONSTRUCTION OF THE NEW PANAMA RAILROAD.

The completion of the canal will necessitate the abandonment of the present main line of the Panama Railroad, and preliminary surveys for location of a new line on the east side of the canal were commenced the latter part of July and completed in November. The location of the line was practically determined in March, and involves the excavation of 1,600,000 cubic yards of material and the placing of

PLATE 7.



ANCON



The main line at Gatun now passes over a portion of the site that must be occupied by the dam, and in order not to delay work on this structure it became necessary to commence so much of the new line around Gatun as would enable the abandonment of the existing line and permit construction of the dam upon this portion of the site. With this in view operations were begun in the vicinity of Mindi and at Gatun on the new location in May. It was also considered advisable to open up from the present main line diversion tracks to the fills that have to be made so as to utilize material removed from the Culebra and Chagres divisions.

By June 30 branches from the main line had been started at Pedro Miguel, Gatun, Lion Hill, Gamboa, Miraflores, San Pablo, and La Boca Junction. A trestle 500 feet in length was driven at Gatun and a dumping trestle was being driven at Pedro Miguel. Three permanent culverts were begun at Pedro Miguel and one at Mindi.

In the construction work on the new line a total of 36,661 cubic yards of material was excavated and, including material from Culebra cut, 92,180 cubic yards were hauled and placed in embankment, permitting the laying of 6,852 linear feet of permanent track. In doing this work four steam shovels and one pile driver and an average of 1,100 laborers were engaged.

SURVEYS.

Geological survey.—A geological examination of the section of the Isthmus to be traversed by the canal was made during the year. The survey was undertaken for practical purposes, the object being to secure information in regard to the character of the sites for the locks and dams, to the classification of material to be excavated, and to determine the resources of the country in regard to building material. Much interesting and valuable data were obtained, that of most import being the availability and suitability of materials for the manufacture of Portland cement on the Isthmus in the vicinity of Gatun. The materials were combined and made into a cement which tests show to be the equal of the best grades manufactured in the United States.

Detailed information on this subject of cement, as well as on the formations to be encountered in the construction and excavation of various parts of the canal, is given in Appendix E.

Canal Zone boundaries.—The center line of the canal being practically determined, surveys were made to fix the Zone boundary lines, which, under the treaty, are 5 miles on either side of the center line of the canal. Associated with the Commission in this work was an engineer representing the interests of the Republic of Panama.

The boundary lines are marked by monuments of 4-inch wrought-iron pipe, about 4 feet long, with a brass cap suitably marked. The

monuments are set at all points of intersection of tangent lines, and other points where the lines cross streams, roads, and on prominent hills.

Miscellaneous.—Arrangements were made to project a map of the Isthmus, using therefor data of all surveys so far made, showing the watersheds of the canal.

An amount of detail work has been done in preparation of plats showing properties belonging to the Commission and lands claimed by private parties, as well as in lithographic reproduction of maps needed by the various departments.

CONTRACT VERSUS HIRED LABOR.

Under date of October 9, 1906, sealed proposals were invited for the complete construction of the canal in accordance with the approved plans, bids to be opened on January 12, 1907. As none of the bids received appeared to be entirely satisfactory, they were rejected, and the work was continued in the same manner as it was progressing at the time that the invitation was issued.

There is no question that in the majority of cases in the United States work is contracted because it can be done cheaper by that method than any other. This is generally due to the fact that the contractor has on hand a construction plant which can be more cheaply hired than purchased anew. Where, in any particular case, either from the nature of the work or its location, the contractor must purchase machinery and appliances which, so far as he can foresee, will be practically useless on the completion of the work, or where the party having the work done can make use of the plant subsequent to its completion, the advantages of the contract system disappear.

As illustrative, the Government secured cheaper and incidentally better concrete work in its fortifications than was obtained by contract. The batteries are heavy concrete constructions requiring machinery for which the contractor could find little, if any, subsequent use. For the same reason the Government, in many cases, especially where the work was removed from commercial centers, was able to construct locks and dams more cheaply than could a contractor. In some instances, to overcome a combination of contractors, the Government purchased the necessary plant and accomplished results more cheaply than by contract; this is notably true in dredging operations, as recent legislation on the subject clearly indicates. It is not uncommon in the execution of comparatively large projects that the contractors have failed and the Government carried successfully to completion, by hired labor, the work undertaken by the contractor. Notable instances of the Government suc-

cessfully completing work are the State, War, and Navy Department building and the Congressional Library, Washington, D. C.

Omitting profits derived from subsistence and general stores, and assuming the hours of labor the same in both cases, it stands to reason that the Government, when warranted in making the necessary outlay for plant, can do work cheaper than a contractor, for no question of profits enters into consideration.

The question of Government work versus contract in connection with the Panama Canal has been discussed, and a conclusion reached in favor of the latter method because of certain stated advantages that are claimed to result. To those familiar with river and harbor improvements, erection of public buildings, light-houses, etc., and with contracts under the Government, the advantages set forth are not so apparent or real.

It is claimed that contractors have under their control and at their disposal trained labor forces, and that by a combination of such forces, through an association of contractors, team work will result, thereby accomplishing the desired end more quickly. As a matter of fact, conditions seldom enable a contractor to maintain intact his entire organization on one piece of work for transfer to another; the completion of a job means the disbanding of the force, and though new work may bring to him some of his old men, a new organization must in each case be perfected.

The Panama Canal presents a piece of work unprecedented in magnitude, which must be done under conditions entirely different from similar classes of work in the United States. The work naturally divides itself into dredging, dry excavation, the construction of the locks and dams, and the construction of the new Panama Railroad. There is no contractor or syndicate of contractors that by any combination could bring to the Isthmus an organization ready for team work on any of these units. While it is possible for several contractors to combine forces, assuming that a sufficient number of men can be gotten together in that way, there still remains the necessity for whipping this force into shape in order to secure an organization that will produce the team work so advantageous in the accomplishment of results.

From the United States the supply of labor is the same whether the work be done by contract or by the Government, and the character of the labor must be the same. So long as work is plentiful the dread of the Tropics will deter men from seeking work here in preference, and this is equally applicable to the contractor and the Government. An adequate supply of labor from the United States is not possible, and recourse must be had to securing it abroad. The records here show that no contractor can even attempt to recruit labor in the West

Indies, and that great opposition will develop to any recruiting by authorized agents of the Commission if the labor procured is turned over to contractors. These island governments can not be blamed for their hostility toward the latter because of their experience under the French, which left an indelible impression throughout the West Indies. A representative of the Italian Government has recommended to the authorities that Italian labor be permitted here for employment under the Commission, but he is not favorably inclined to the control of such labor being vested with a contractor.

It is true that in some cases the contractor may have an acquaintance which will enable him to secure suitable men more easily than a Government agent, and, again, he may bring to a work a greater experience, but so far as the most important parts of the Panama Canal work are concerned, this advantage is not apparent. In any case the knowledge of the specialist in the particular work that is to be done is the element that will accomplish the most satisfactory results, and, so far as dredging and lock and dam construction are concerned, the Government's experience has been, if not greater, at least as extensive as that of any contractor or association of contractors that can be secured in the United States. For these units of the work the Government's acquaintance is equally extensive, and experienced men can be drawn from the engineering force of the Government. These three classes of work form the most important parts of the Panama Canal, and in their prosecution the Government has the advantage. So far as relates to excavation in the dry by steam shovel and cars the advantage ordinarily would be with the contractors, yet the Government has secured and maintained an organization on the Isthmus that can not be surpassed by any contractor, and, it is claimed, has perfected this organization in as short a time as, under the circumstances, could have been done by any association of contractors.

When the Government does work in the United States the wage scale is determined by the amount paid for the same class of labor in the immediate vicinity; there is no pressure brought to bear on higher authority for any increase over the salaries or amounts offered, and strikes are unknown. It is true that conditions on the Isthmus are such that demands for increase in pay are frequent, and that to accomplish what was denied by those immediately in charge of the work recourse has been had to higher authority.

Conditions on the Isthmus are peculiar. It is contended, apparently on reasonable grounds, that service in the Tropics saps the energy, and that a man is incapable, after a time, of performing the same amount of work that he would be able to accomplish had he spent the same period in a cooler climate. This creates a desire to accumulate sufficient means to avoid the necessity of relatively harder work on the return to the United States, and is a question that a

contractor would be obliged to face as well as the United States. In some respects the Government is in a position to handle the situation more satisfactorily than a contractor, as was plainly shown by the trouble with the steam-shovel men in May last.

The wage scale on the Isthmus is practically adopted and a contractor would be obliged to maintain it. Under the recent decision that all questions of pay are to be left with the Commission, this body is placed on as secure a basis relative to the constant demands for an increase as any association of contractors.

Experience has shown that continuity of construction is more apt to result in cases where the Government undertakes the task than when it is turned over to contractors. This can be easily verified by an examination of the records (the number of failing contractors) to be found in the office of the Chief of Engineers. For all work done by hired labor continuity of work is merely a question of continuity of appropriations. It is true that continuity may be equally insured by turning the Panama Canal work over to contractors, if the contract is so drawn that practically all risks are assumed by the Government, but why this should be done, at a considerable increase in cost, is not apparent.

To anyone who has had experience with contracts on Government work, the claim that letting a piece of work by contract is a reasonable assurance that it will be completed in a definite time is utterly untenable. On public works, including public buildings, it may safely be said that in the majority of cases the time limit is exceeded. An examination of the contracts for material to be supplied the Isthmian Canal, so far as the time limits proposed by the contracts are concerned, will clearly show that there is no assurance of completion in a definite time of any contract, even though the contractors themselves, when fully cognizant of all the conditions surrounding the work, fix the time for the completion or delivery. It certainly can not be supposed, therefore, that in an enervating climate, like that on the Isthmus, and with labor below that in the United States in efficiency, this time-failing record for contract work would be changed.

Reasonable definiteness in cost is usually obtained by contract, when based on unit prices and when all conditions of the work are fully known in advance, yet these unit prices are as a rule higher than would be the cost to the Government should the latter possess the necessary plant. It is true that the contract which was proposed for the construction of the canal provided for the determination of time and cost by a board of engineers, but the conclusions on these points could be upset should conditions be found or met with unforeseen by that board. Experience on all works, even those based on more definite data than can be presented to contractors for the Isth-

mian Canal work, shows that the unexpected is always happening, and this seems especially true of the work here.

There is no question that there are a number of people who will always believe and contend that any piece of work done by the Government could have been done as well and more cheaply if undertaken by contract, but an examination of the records will generally disprove such a contention. On the other hand, there is an equally large class who will contend to the contrary and claim, after the completion of the work, that the reverse is true.

Work heretofore has been conducted on a nonpartisan basis. The thinking class of American people fully realize the necessity for the Panama Canal and its early completion, and it is generally realized that this can be accomplished only by the application of business and nonpartisan methods. This has generally been the case with all Government work wherever undertaken, and the fact that the continuation of this policy may not continue along the same lines is hardly an argument strong enough to weigh in favor of contract work.

While it has been noted that contractors can usually do work cheaper because of plant already on hand, thereby saving the cost of new machinery, and because of greater familiarity with the class of work on which they are engaged, there are at times additional ways for securing the same results, namely, (a) by paying lower wages, (b) by working their men longer hours, (c) by requiring a greater amount of work per hour from the men, (d) by giving them less expensive rations and quarters, in case employees are fed and quartered.

On the Panama Canal a contractor can not anticipate profits from any of these sources. The work already done and in progress has fixed the wage scale, and a contractor would be unable to retain labor that might be turned over to him, nor could he secure additional men at less salary than already paid by the Commission.

The Government is now working foreign labor as many hours per day as is practicable in this climate, so the contractor could gain nothing more than the Government has already acquired. So far as American labor is concerned, the eight-hour law is applicable, and so long as it remains in force it must be as binding on the contractor as on the Government.

It is questioned whether he could get more work out of the laborers on the Isthmus than they now perform for the Commission. This is a question dependent entirely upon the character of foremen employed, and he would have exactly the same class of men in this position, since most of the foremen now employed have previously been with contractors, and therefore have had their principal train-

ing on contract work. Moreover, the pace set by the laborers under the Commission would fix the rate for the contractor.

Were all the work turned over to one contractor, or an association of contractors, the Commission would be obliged to maintain a supervisory force, and the feeding and quartering of these employees would determine the demands that the contractor's men would make upon him for accommodations. Moreover, a number of the dwellings that are now occupied by Commission employees would be turned over for occupancy by contractor's men, and any additional force would expect the same accommodations. Trouble would result, therefore, in case the contractor fed his employees on less expensive rations or quartered them less comfortably than the Commission; no saving could be made, and the Government would be obliged to foot the bills.

The Panama Canal work is naturally divided into—

(1) Excavation in the dry by steam shovels, including all of the Culebra division and part of the Chagres division. The construction of drainage and diversion channels would come under this heading.

(2) Excavation by dredges on the Colon and La Boca divisions and on part of the Chagres division.

(3) The construction of the dams.

(4) The construction of the new Panama Railroad.

(5) The construction of the terminal facilities, harbor basins, and breakwaters, if any.

(6) The construction of locks, gates, and spillways.

The excavation of the Culebra division has already been undertaken by hired labor; practically all of the plant required for this work has been secured and paid for; a complete and thoroughly efficient organization for the same has been built up, and the Government is not hampered in any way in procuring the necessary labor for filling vacancies that arise. In the organization that has been perfected the higher grade men were formerly employed by contracting firms, and some of the number have been successful contractors themselves. The conduct of this work, therefore, has been along the lines usually followed by contractors. Under the circumstances no advantage would accrue to the United States by letting this piece of work to contractors, but on the contrary there would be not only additional expense, but a feeling of unrest and dissatisfaction engendered among the present employees materially affecting efficiency. Under existing conditions, therefore, contract work can not be recommended for the Culebra division.

The Government has on hand, or under contract, all the dredges that will be needed for excavating such parts of the canal prism as can be most economically performed by this class of machinery. Experience in the United States has demonstrated that with such a

plant in its possession no contractor or association of contractors can do the work as economically as can the Government. The Government agents are as familiar with this class of work as the contractors, and the necessary dredge crews can be obtained without difficulty. So far, therefore, as dredging is concerned, the Government should do the work and contracts for the same can not be recommended.

The great problem in the construction of that portion of the canal included in the Culebra division is the disposal of the excavated material. In the main this has been disposed of at various localities favorably situated with regard to the cut. The systematic performance of the work and the necessity for additional material in completing other parts of the work have made it necessary to arrange for such a disposition in the future as will be most beneficial to the work in its entirety. The efficiency of the dams depends upon their having sufficient weight and tightness to impound the water without leakage and without danger to the stability of the structures. The weighty material, or rock, is to be furnished in each instance by material from the Culebra cut and the tightness is to be secured by the selection of suitable material to be obtained from the products of dredging. In other words the construction of the dams is so intimately connected, both with the excavation of the Culebra cut and the dredging, that if these two can be most economically and advantageously done by the Government rather than by contract it naturally follows that the method adopted for the construction of the dams must be the same, namely, by hired labor under Government supervision and not by contract.

The survey of relocation for the Panama Railroad has been completed and it has been necessary to undertake the construction of the railroad in order to permit the removal of the present bed in the vicinity of Gatun, so that the construction of the dam at that point may be begun. The construction of the new line requires, among other things, about 1,600,000 cubic yards of excavation and about 12,000,000 cubic yards of embankments. The excess of embankments over excavation, about 10,000,000 cubic yards, is to be supplied largely, if not entirely, from material excavated from the canal prism, the embankments forming dumps for the material trains. Steps have already been taken for the development of dumps which will result in the construction of a part of the new roadbed at Miraflores, Pedro Miguel, Gamboa, and Gatun, and plans have been prepared and proposals invited for a bridge across the Chagres at Gamboa. With excavation in the Culebra division to be done by hired labor under Government supervision, with the material therefrom to be used in the construction of the Panama Railroad, the intimate relation between the two necessitates the adoption of the

same method of construction, namely, hired labor under Government supervision, in the construction of the new Panama Railroad.

The regulating works and spillways of the Gatun and La Boca dams are so dependent upon and intimately connected with the construction of the dams that whichever method is adopted for the latter must be made applicable to the regulating works and spillways, in order to avoid friction and difficulties that would result in case part were done by the Government and part by a contractor.

The Panama Railroad must be maintained and operated as a commercial line, and it must be utilized also for construction purposes in connection with the Culebra cut, the reconstruction of the railroad, the construction of the dams, and in addition it must transport all materials entering into the construction of the Pedro Miguel locks.

The difficulties that would result from a joint use of the Panama Railroad by a contractor and the Government at the Pedro Miguel locks disappear, however, for the locks at Gatun and La Boca, since both are accessible by water. Sand can be procured along the shores of the Pacific, and a suitable quality in sufficient quantity can also be obtained on the Atlantic shore of the Isthmus.

The success of the lock construction depends largely upon the quality of cement used, and there is no question that the Government should furnish all the cement. No contractor, or association of contractors, possesses the necessary plant for handling the enormous quantities of concrete required for these structures. Subsequent to the construction of the locks the contractor could have no further use for the machinery installed, even if the payment of freight for its return to the States were warranted. If the contractor furnishes the plant, the Government must pay for it in its entirety and in addition pay interest on the amount expended for its purchase. This plant can be procured more cheaply by the Government than by a contractor. As previously explained, if the Government furnishes the plant, the advantage of the contract method disappears. The contractor will have greater difficulty in securing the common labor needed than will the United States. The engineering force of the Government that has in the past few years been employed in the construction of such large quantities of concrete in various forms in the United States can be drawn upon to furnish the skilled personnel necessary for concrete work here. The acquaintance with competent men, for this class of work, is more extended on the part of the Government than on the part of the contractor.

These considerations lead to the conclusion that the locks can be more economically and advantageously constructed by the Government than by a contractor or association of contractors.

The gates and operating machinery can, it is believed, best be constructed by contract at the proper time.

The foregoing conclusions do not cover the proposed work on the Chagres division or the terminal facilities, harbor basins, and breakwaters, as the surveys for the development of the amount of work and character of material involved in the Chagres division have not yet been completed, nor have the final plans for terminal facilities, etc., been finished.

No account has been taken of the question of sanitation, one very important to the successful prosecution and completion of work on the canal. Proper sanitation can be maintained more easily and satisfactorily with the Government in supreme control of the work than with a contractor, and this adds an additional argument in favor of the Government doing the work itself.

The relative advantages of the contract system versus hired labor under Government supervision in the construction of the Panama Canal are very different to-day from what they were two years ago, and were different then from what they were when the work was first undertaken. To one familiar with conditions on the Isthmus there can be no doubt at this stage of the work as to the advisability of continuing it by hired labor.

It is estimated that 80 per cent of the entire plant needed for the construction of the canal has been purchased or contracted for. Machine shops have been erected and equipped for making all needed repairs to the machinery now on hand or still required for the work. So far, therefore, as the plant and its care and repair are concerned, the Government is better equipped to carry on the work as advantageously and economically as any contractor.

Many thousand employees have been secured, and an effective working organization has been perfected, and the recruiting system put in operation is capable of furnishing more labor than can be advantageously used. The employees are well sheltered and, in general, well fed; the salaries paid are satisfactory and the work is progressing smoothly. A change from these favorable conditions in the method of prosecuting the work would disorganize all existing conditions and would undoubtedly increase the estimated cost and time of completing the canal.

The conclusion that the work can be done better, cheaper, and more quickly by the Government has been reached only after free and full discussion by the various members of the Commission and the higher officials connected with the construction work, and after careful consideration of all sides of the proposition.

LABOR, QUARTERS, AND SUBSISTENCE.

This department is charged with securing all skilled and unskilled labor and its assignment, according to the needs of the work. It is the custodian of all living quarters, allotting them to employees

according to their standing as gauged by salary earned and in conformity with rules and regulations approved by the Commission.

It supplies furniture to quarters, delivers distilled water to residences, offices, and shops, and is in direct charge of the delivery of all food supplies, including ice, bread, and cold-storage articles from railroad stations or local commissaries to residences, hotels, messes, and kitchens.

It polices the grounds around camps and quarters, cleaning up waste and refuse material which is placed within reach of those charged with its final disposition. It also has charge of the lighting of the camps and of roads to and through them.

It operates the hotels, messes, and kitchens for the accommodation of the employees of the different grades—the hotels for white Americans, the messes for Europeans, and the kitchens for the natives of the West Indies.

It keeps the service history of each individual employee in the general personnel record of which it is the custodian; issues by order of the chairman and enters therein all orders pertaining to leaves of absence, sick leave, resignations, discharges, promotions, and reductions. It also authorizes the issuance of steamship transportation and special rates to which employees are entitled.

Labor supply. The skilled labor force is recruited in the United States. Agents of the Commission receive applications for all outside positions, personally examining the individual and looking into his previous service record. This includes trainmen, steam-shovel operators, foremen, and mechanics. Clerks, stenographers, draftsmen, doctors, and nurses are secured through the civil service registers. The skilled force on June 30, 1906, was approximately 2,500, and on June 30, 1907, actually 4,404. To increase this force 1,904 men and provide for the usual separations, due to sickness, resignations, etc., 3,038 men were brought from the United States during the year.

The unskilled force is brought from the West Indies and Europe. Recruiting agents are located in Barbados and Martinique, and a representative in Paris, France, to keep in touch with European labor conditions and with European emigration. On June 30, 1906, there were on the canal work 500 Europeans and 13,625 West Indians. June 30, 1907, there were 4,317 Europeans and 14,606 West Indians. To maintain this force of laborers, and also provide the Panama Railroad force of about 5,000 laborers, 6,899 Europeans and 10,947 West Indians were brought to the Isthmus—an average of nearly 1,500 men per month—to meet the demands of the work for common labor during the year.

The total force of skilled and unskilled laborers of the Isthmian Canal Commission and Panama Railroad on June 30, 1906, was

19,600, and on June 30, 1907, it was 29,446—an increase in the total of 10,000 men. During this period 20,884 men were brought to the Isthmus from the United States, Europe, and the West Indies. The labor problem is still an unsolved one, but the experiments of the past year with a diversity of races and nationalities has improved the efficiency of the force and promises to make the term of service longer. Tropical labor is migratory, and notwithstanding superior wages, housing, and subsistence, there will always be large periodical changes in the individual force. A regular recruiting organization, changed from one labor center to another, will always be necessary to keep a maximum force available.

Quarters.—At the close of the last fiscal year 1,129 houses were available for quartering employees of all classes, furnishing buildings for offices, hotels, messes, kitchens, and storerooms. On June 30, 1907, 2,208 buildings were in use for the same purposes. Considering the large increase in the skilled force and the number of women and children provided for during the past year, the number of people from the United States in quarters now, as compared with the close of the last fiscal year, is just about doubled, but they are all better and more comfortably housed than at this period last year. New houses are being turned over every day, and each house finished relieves the congestion, if any, in that particular locality, or enables some employee to send for his family. The congestion in the quarters of the common laborers has entirely disappeared, due to two causes, first, the completion of a great many houses during the past year, and, second, the fact that with improvement in efficiency it is not necessary to house as large a number of men as formerly.

Subsistence.—At the close of the fiscal year 15 hotels were operated for white Americans, where good wholesome meals are furnished for 30 cents each. These hotels are under the direction of stewards from the United States, and the cooks are generally Americans or men who have had experience in hotels and restaurants in the United States.

The Hotel Tivoli, at Ancon, is operated also for employees, but on account of superior accommodations and appointments higher rates prevail.

Eighteen mess halls are operated for the Europeans, where a day's board is furnished for 40 cents. The stewards and cooks at these messes are usually Europeans, and a meal peculiar to the tastes of the men boarding there is served.

There are in operation 23 kitchens for the West Indian laborers, where a day's board is furnished for 30 cents and is made up of such food supplies as they are most accustomed to and prepared by cooks of their own country. The common laborer of the West Indies is employed upon a basis of subsistence being part of his compensation. This was found advisable on account of his careless habits and the

fact that insufficient nourishment impaired his usefulness as a laborer, and sooner or later landed him in the hospital.

These hotels, messes, and kitchens are inspected daily by the supervising employees of the department of labor, quarters, and subsistence, and weekly by the district physician. All meats, vegetables, and food supplies are carefully inspected before they are used.

The number of meals served during the month of June, 1907, is as follows: Hotels, 197,419; messes, 286,155; kitchens, 456,765, or nearly a million meals for the month.

The subsistence operations are merely self-sustaining, and it is not the purpose to make a profit. They are operated upon the basis of contributing messes as far as possible.

For further details of this department attention is invited to Appendix F.

ZONE GOVERNMENT.

The department of civil administration embraces the affairs of government of the Canal Zone, the courts, the office of the prosecuting attorney, and the divisions of revenues, posts, customs, lands, administration of estates, police, education, fire protection, and public works.

Governor Magoon left the Isthmus September 25, 1906, when the duties of his office devolved upon the executive secretary until November 17. The Executive order of November 17, 1906, created the department of law and government under the general counsel, after which date governmental matters were handled in Washington by the general counsel through the executive secretary on the Isthmus. On April 2, 1907, an Executive order vested the authority of the chief executive of the Zone in the chairman of the Commission, and by order of the latter the duties were assigned to one of the Commissioners.

Under the authority conferred upon the President by existing law to legislate for the Zone, the five municipalities into which the Zone was divided were abolished and administrative districts were created in their stead. The United States patent, trade-mark, and copyright laws were extended to the Zone; provisions were made for regulating insurance companies, for the registration of land titles, and the celebration of marriages. The penal laws were amended, and a new code of civil procedure was put into effect.

By the order of March 13, 1907, the Commission is authorized to enact, with the approval of the Secretary of War, ordinances relating to police, sanitation, and taxation, and matters formerly regulated by municipal ordinances. By virtue of this authority the Commission enacted ordinances regulating the sale of liquor and prescribing certain taxes in the Zone.

A joint commission, consisting of B. S. Ambler and Montgomery Blair, representing the United States, and C. Arosemena and S. Lewis, the Republic of Panama, undertook to settle certain claims against the Commission, due to loss or injury to private property, and to fix the value of lands required for canal purposes. This commission was unable to agree upon the value of any of the property considered by it except the islands in Panama Bay and the improvements thereon. In the claims originating from the Malambo fire, while unable to determine the origin and cause of the fire, the commission recommended payment by the United States to the claimants of amounts aggregating \$54,037.

A question was raised as to the right of the Central and South American Telegraph Company to land its cable through Manzanillo Bay under authorization by the Secretary of War, without permission of the Republic of Panama. It is claimed by the latter that the 3-mile limit, included within the Zone limits under the jurisdiction of the United States as stipulated by the treaty, is measured along the center line of the canal as finally determined, and from the point of intersection of this center line with the low-water mark of Limon Bay; further, that the Zone is bounded on the north by a line perpendicular to this center line through the point 3 miles out. With this interpretation of the treaty provisions, the Republic of Panama claims that the cable passes through waters over which Panama still exercises sovereign rights, and her permission must be obtained. It is to be noted in this connection that, under such a contention, the ends of the canal are under the control of Panama. Action against the cable company is deferred until this question of the delimitations of the Canal Zone is definitely settled.

Under the treaty the United States was authorized to construct waterworks and sewers as sanitary measures in the cities of Panama and Colon. The paving and other work contemplated are practically completed and the United States is to be reimbursed for the cost of paving through water rents. Contracts with the Republic of Panama, effective July 1, 1907, on the subject of the Panama and Colon water rates, were agreed upon and executed shortly after the close of the fiscal year.

During the dry season 37.31 miles of roads and trails were built in the Zone. The character of the trails through adjacent country is such as to render transportation by pack animals a necessity in handling agricultural products, so that trails from 6 to 8 feet wide answer every requirement. The opening of these trails is expected to increase the number of agricultural leases, as a large amount of valuable agricultural land, hitherto inaccessible, has now been made available. A macadamized road was constructed from Empire to Culebra.

There being some question whether there is authority for the extradition from the Canal Zone of fugitives from justice to any foreign country having an extradition treaty with the United States, it is considered advisable to extend the extradition laws and treaties of the United States to the Zone by Executive order.

Under the authority vested in the Commission to exclude and deport certain undesirable classes of persons there were 56 deportations during the fiscal year, exclusive of the deportation of persons certified to be chronically sick.

Sixteen post-offices were in operation in the Canal Zone and the amount of business handled at these offices steadily increased; 90,928 letters and parcels were registered, and the amount of money orders issued was \$2,318,965.34. Money orders were largely purchased by employees on the line of the canal for the purpose of securing a safe depository for their funds, there being an entire absence of banking facilities outside of the cities of Panama and Colon. Efforts were made to advertise, by circular and otherwise, the money order system among the European laborers in order to save them the payment of large rates of exchange.

The customs service of the Zone is confined to entering and clearing vessels arriving at the ports of Ancon and Cristobal, filing manifests, recording protests, and the usual services to seamen. Docks were constructed at those ports equipped with modern appliances.

In the division of internal revenues distillation licenses to the amount of \$5,198.95 were collected.

The total number of leases for building lots in force on June 30, 1907, was 479; for agricultural lands 83, the latter covering 344 hectares of land.

The collector of revenues is ex-officio administrator of estates for the Canal Zone, where the decedents were citizens of the United States and the estates consist entirely of personal property not exceeding in value \$500. Administration services were performed on 29 estates during the year.

The funds of the Canal Zone are derived from the rental of lands and buildings, the postal service, court costs and fines, and taxes. All expenses of the school system, the cost of public improvements, and the miscellaneous and contingent expenses of the Canal Zone government were defrayed from these funds, with the exception of the revenues from the postal service, which were applied solely toward defraying the expenses of that service.

Civil cases tried and settled in the several courts of the Canal Zone numbered 358. Several decisions of importance were rendered by the supreme court, among them the cases of Coulson and Andrade. In the former case the defendant (Coulson) was convicted in the circuit court of the second circuit of murder and sentenced to death. Dur-

ing the trial of the case the defendant's attorneys moved by jury, which motion was denied by the court. The decision of the lower court was affirmed. The latter ejectment, brought in the name of the United States, to recover possession of lands occupied by him. The defendant, who was in possession of the lands, pleaded the statute of limitations and argued that the government must prove its title. The court held that the statute of limitations does not run against the government and that the burden is always upon the party claiming adversely to the government to prove title.

On June 30, 1907, the effective force of the police consisted of 181 officers and men. During the year 6,200 arrests were made, from which resulted 5,193 convictions. The largest number of arrests was principally due to the influx of foreign laborers from the Isthmus who are unfamiliar with the laws of the Zone. Improvements in jails and penitentiaries were made to improve the conditions of prisoners. As marshal of the Zone the chief of police served 310 summonses, 663 subpoenas, and 10 executions. Acting as coroner he held 136 inquests.

Fire protection throughout the Zone was largely improved by the construction of additional fire stations and the installation of more extensive fire-fighting equipment. The number of paid firemen was increased and volunteer companies were organized at more important points along the line.

The work of the superintendent of public works is confined to the operation of the waterworks and sewerage system, the letting of contracts for connections with the mains, the enforcement of plumbing regulations and the collection of water rates. The work proceeded satisfactorily, and at the close of the fiscal year 1907 connections had been made and 133 fire hydrants and 100 water faucets placed. For the seven months ended June 30, 1907, the City of Panama paid \$4,486.20 for water for public use. The daily consumption of water at the close of the fiscal year was 1,643,000 gallons. Meters were installed on all private connections. In the city of Colon the work was confined to the inspection of the waterworks, the receiving of applications for service connections, and the collection of water rents. Connections to the sewerage system progressed satisfactorily.

Much attention has been given to the subject of schools in the Zone for the benefit of children, especially those employed by the Commission. The average enrolment for the year was 1,643, and the average attendance 1,138. During the year 10 new schools were opened at different points. The list of the division of schools included 31 teachers. The regrading of the salaries of teachers it is hoped that the

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ing the trial of the case the defendant's attorneys moved for a trial by jury, which motion was denied by the court. Upon appeal the decision of the lower court was affirmed. The latter case was one of ejectment, brought in the name of the United States against Andrade to recover possession of lands occupied by him. The defendant, who was in possession of the lands, pleaded the statute of limitations and argued that the government must prove its title to the land. The court held that the statute of limitations does not run against the government and that the burden is always upon a person claiming adversely to the government to prove title.

On June 30, 1907, the effective force of the police department consisted of 181 officers and men. During the year 6,236 arrests were made, from which resulted 5,193 convictions. The large number of arrests was principally due to the influx of foreign labor to the Isthmus who are unfamiliar with the laws of the Zone. The improvements in jails and penitentiaries were made to the betterment of conditions of prisoners. As marshal of the various courts the chief of police served 310 summonses, 663 subpoenas, and levied 4 executions. Acting as coroner he held 136 inquests.

Fire protection throughout the Zone was largely increased by the construction of additional fire stations and the installation of effective fire-fighting equipment. The number of paid members of the force was increased and volunteer companies were organized at the more important points along the line.

The work of the superintendent of public works in Panama was confined to the operation of the waterworks and sewer systems, the letting of contracts for connections with the mains, the enforcement of plumbing regulations and the collection of water rents. This work proceeded satisfactorily, and at the close of the fiscal year 1,023 connections had been made and 133 fire hydrants and 22 public taps placed. For the seven months ended June 30, 1907, the Government of Panama paid \$4,486.20 for water for public use. The average daily consumption of water at the close of the fiscal year was 749,800 gallons. Meters were installed on all private connections. In the city of Colon the work was confined to the inspection of plumbing, the receiving of applications for service connections, and the collection of water rents. Connections to the sewerage system in Colon progressed satisfactorily.

Much attention has been given to the subject of suitable graded schools in the Zone for the benefit of children, especially of Americans employed by the Commission. The average enrollment for the year was 1,643, and the average attendance 1,138. Twenty-four schools were opened during the year at different points. The personnel of the division of schools included 31 teachers. Through a regrading of the salaries of teachers it is hoped that the standard of

PLATE 8.





the force will be improved, and afford to the children of American employees school facilities as broad in scope and purposes as those afforded by schools in the United States.

Further details in connection with the work of the department of civil administration are given in Appendix G.

SANITATION.

By Executive order of November 17, 1906, sanitation was separated from the department of government, of which it was a division, and created a new department under the Commission.

The work of sanitation was carried on throughout the year, increasing in amount and extent as new engineering construction was undertaken. Its success depends upon the ability to protect employees against the malarial mosquito, and this is accomplished by draining and clearing the ground in the neighborhood of villages, in addition to proper quartering. The following, in brief, is the work done in the Zone along these lines: Brush cut, 16,000,000 square yards; swamp lands filled and drained, 1,000,000 square yards; grass burned, 30,000,000 square yards; ditches dug, 217,000 linear feet; tile ditches laid, 50,000 feet, and cemented, 50,000 linear feet. Other functions were performed in addition, such as the disposal of night soil, the removal of garbage, and the care of cemeteries.

Outside of the limits of the Canal Zone the department performed such sanitary work in the cities of Panama and Colon as was necessary to control health conditions and to keep infection from the Zone. A medical officer with a small force is established at Bocas del Toro to keep the town in such condition as to maintain quarantine against the introduction of yellow fever and to prevent the spread of it should it break out. Yellow fever has been kept out during the year.

Too much credit can not be given the department for the elimination of yellow fever, which permits the successful prosecution of the work. There was no yellow fever originating on the Isthmus during the year, though one case was brought in from shipping, the patient having passed the period of infection.

Six cases of smallpox were taken from vessels entering at Colon; one case was introduced into the city in the early part of the year from Colombia, the disease breaking out four or five days after arrival. From this 35 to 40 cases developed in Colon, but as they were promptly isolated, the people in the neighborhood vaccinated, and the houses concerned carefully fumigated, there was no further spread of the disease in the town and it did not extend to the Canal Zone.

About 3,000 persons who had been exposed to yellow fever or small-pox were held in quarantine for observation.

The largest subdivision of the department has to do with the care of the sick, requiring for its maintenance more than half of the sums appropriated for sanitation. Medical attendance and medicines, both in the hospitals and in quarters, are furnished gratis to employees of the Commission and of the Panama Railroad. To the families of employees a charge is made for treatment.

The average daily force of skilled and unskilled laborers of the Commission and Panamá Railroad was, at the beginning of the year, 19,600 and at its close 29,446. The average daily sick in quarters and in hospitals for the year was 916. So far as can be determined from such data, a comparison of the death rates among employees for the fiscal years 1905-6 and 1906-7 will show a marked improvement in health conditions during the past year, mainly due to sanitation, and also to better housing facilities and better food supplies. While death rates may be used as a basis for showing improvement in the health conditions on the Isthmus from year to year, they give no data for a comparison of this locality with other communities, because only the healthy in the prime of life are employed, and also because of the migratory character of the laborers, as will be seen by an examination of Appendix F.

During the fiscal year suitable buildings were constructed and the lepers removed to the new colony at Palo Seco.

Five new hospital buildings were constructed within the Zone, additions made to seven of the previously existing wards, and two new wards added to existing hospitals, increasing the number of hospital beds to a normal capacity of 1,845 as against 1,252 at the beginning of the year, and an increase of an emergency capacity of 587 cots. Two buildings have been constructed at Ancon, one a ward for the insane and the other an insane asylum; to these buildings will be transferred the insane now occupying Miraflores.

At the La Boca terminal the D'Ingler house is used as the quarantine station, but the necessity for occupying a portion of the ground for housing the construction force has led to measures being taken for the erection of a new quarantine station suitable for present and future needs on one of the outlying islands. From surveys made, the island of Culebra was finally selected, which, together with the portion of Naos Island, adjacent to Culebra, will furnish ample grounds for all the structures required.

For further information and details of the work of this department attention is invited to Appendix II.



ANCON HOSPITAL GROUNDS



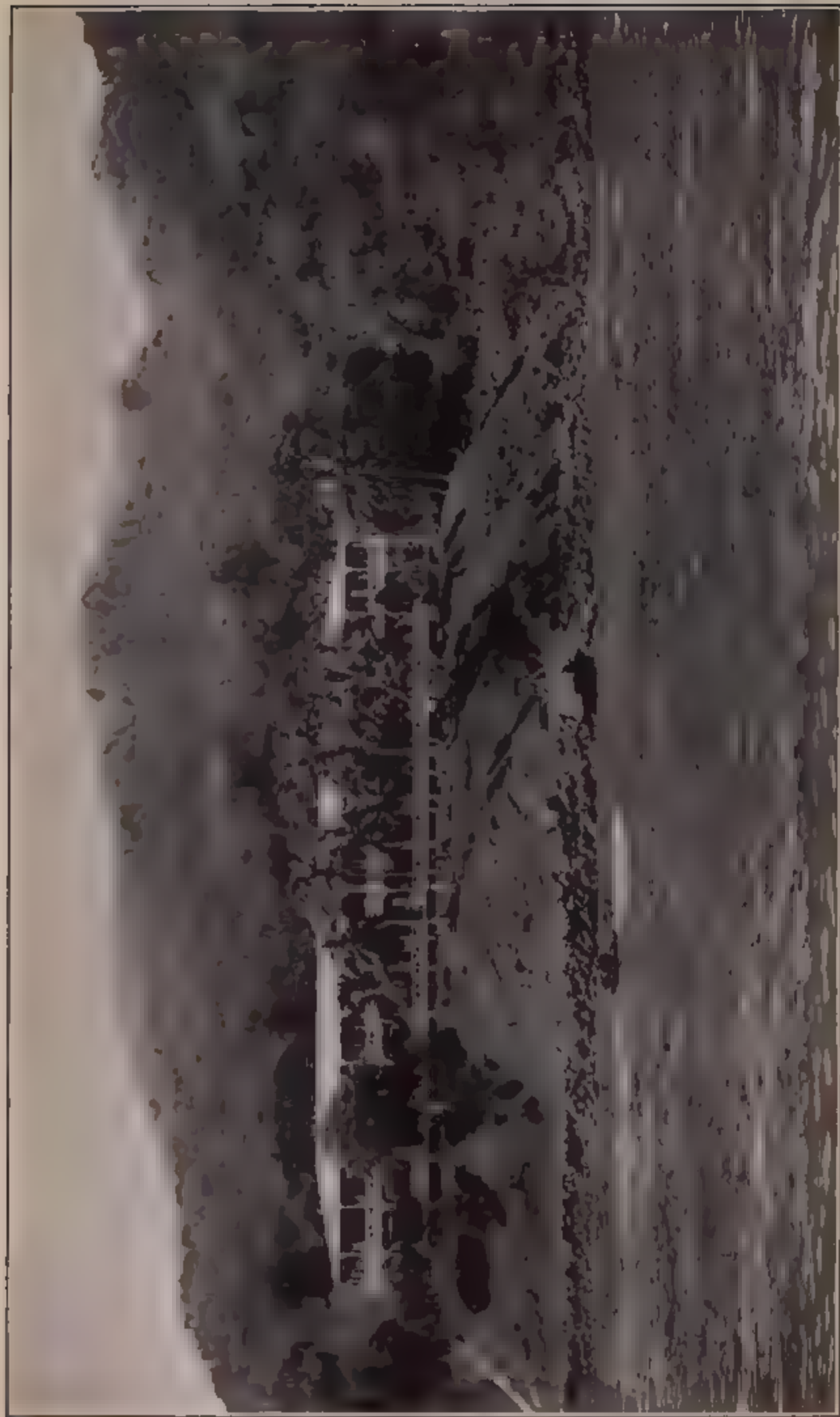
PLATE 10.



DRIVEWAY IN ANCON HOSPITAL GROUNDS



PLATE 11.



I C C SANITARIUM AT TABOGA ISLAND





I. C. C. HOSPITAL AT COLON



PANAMA RAILROAD.

The progress reported as being made during the previous fiscal year was continued during the past year. The rebuilding of the old line is completed and the building of the new double-track, with the exception of four miles from Gatun to Lion Hill, 90 per cent of which is finished, is complete. Additional sidings and storage tracks, made necessary by the enormously increased business due to Commission dirt trains, were built. A block system of dispatching trains was put into use on the double track, affording the freest possible movement of trains consistent with safety.

During December, 1906, an unusual flood occurred in the Chagres River, which at Matachin, reached an elevation of 78 feet, or 30 feet above low water. Between Mindi and Bas Obispo 15 miles of track were submerged from 1 to 8 feet, but, aside from softening the new double-track bed and washing away about 2,000 cross-ties, no serious damage was done.

The amount of traffic has been so heavy that the 70-pound rails are proving too light and steps have been taken to increase them to 90 pounds, especially on the curves. A new coal-handling plant at wharf No. 14 has facilitated the unloading of coal to such an extent as to reduce the freight rate per ton. The new yards at La Boca are finished.

- The service of the steamers operated by the Panama Railroad Company reduced, in lay-over time, one day in the early part of the fiscal year, has been again modified by resuming the former schedule, due not to the fact that the freight could not be handled promptly and efficiently but to the time allowance between the time of arrivals and departures not being sufficient to make the necessary repairs to machinery.

Under the provisions of the last appropriation act new equipment has been added as follows: One hundred Rogers ballast cars; 273 box cars; 10 stock cars; 12 caboose cars; 2 Rogers ballast sand plows; 9 first-class coaches, length 68 feet; 10 second-class coaches, length 68 feet, and 4 baggage and mail coaches, length 68 feet.

COMMISSARY.

Supplies are furnished to the hotels, messes, kitchens, and employees of the Commission and Panama Railroad by the commissary department of the railroad, which has developed into a modern department store. Seven branch stores, located at Gatun, Gorgona, Empire, Culebra, Rio Grande, Paraiso, and Pedro Miguel, are also in operation. In connection with the commissary there are

in operation, constructed during the year, cold storage and ice plants, a well-equipped laundry and a bakery, all at Cristobal.

RECREATION FOR EMPLOYEES.

The four club houses, reported as under construction during the previous fiscal year at Culebra, Empire, Gorgona, and Cristobal, were completed and are now in operation, their management being placed under the Young Men's Christian Association. The club houses are under the control of an advisory board selected by the Commission. The influences of the club houses are excellent.

During the year a chapel was constructed at Ancon, and three buildings, one at each of the following places—Culebra, Gorgona, and Cristobal, appropriate for holding religious services and available for all denominations and creeds. The latter buildings are two-story structures, the upper floors of which are fitted as lodge rooms for various orders and societies formed among the employees. Another building of this type is in course of erection at Gatun.

WASHINGTON OFFICE.

Until the changes in its organization in March, 1907, the main office of the Commission was in Washington, D. C. Since that time a reorganization has been effected in the Washington office, resulting from the fact that the entire personnel of the Commission is now stationed on the Isthmus. This reorganization was in progress at the close of the fiscal year, and has resulted since then in placing the Washington office in charge of the general purchasing officer of the Commission and in a considerable saving in expense.

MONEY STATEMENT.

Appropriations.

June 28, 1902.	Canal connecting Atlantic and Pacific oceans	\$10,000,000.00
Dec. 21, 1905.	Canal connecting Atlantic and Pacific oceans	11,100,000.00
Feb. 27, 1906.	Material purchases in United States.	1,000,000.00
	Miscellaneous expenses on Isthmus.	400,000.00
	Panama Railroad and second track..	200,000.00
	Isthmus pay rolls	2,000,000.00
	Salaries and incidental expenses in United States.....	75,000.00
	Equipment purchases	1,565,786.00
	Reequipment Panama Railroad.....	650,000.00

Total available appropriations to June 30, 1906. \$26,990,786.00

MONEY STATEMENT—continued.

Appropriations—Continued.

June 30, 1906.	Expenses in United States.....	\$368, 242. 69
	Salaries	\$251, 063. 33
	Incidental ex- penses.....	117, 179. 36
	Construction, engineering, and ad- ministration.....	21, 018, 537. 24
	Pay officers and employees.....	\$2, 600, 512. 00
	Pay skilled and unskilled labor.	8, 650, 661. 00
	Material pur- chases	9, 032, 814. 24
	Incidental ex- penses on Isth- mus	734, 550. 00
	Civil administration	968, 200. 00
	Pay officers and employees.....	\$600, 000. 00
	Pay skilled and unskilled labor.	50, 000. 00
	Material and in- cidental ex- penses	318, 200. 00
	Sanitation.....	2, 101, 435. 15
	Pay officers and employees.....	\$600, 000. 00
	Pay skilled and unskilled labor.	679, 068. 00
	Material and in- cidental ex- penses	822, 367. 15
	Reequipment of Panama Railroad ..	1, 000, 000. 00
	Total appropriation year 1907.....	\$25, 456, 415. 08
Mar. 4, 1907.	Expenses in United States	\$253, 000. 00
	Salaries	\$184, 000. 00
	Incidental expenses	69, 000. 00
	Construction, engineering, and admin- istration	20, 366, 000. 00
	Pay officers and em- ployees.....	\$2, 772, 000. 00
	Pay skilled and un- skilled labor	7, 990, 000. 00
	Material purchases.	9, 046, 000. 00
	Incidental expenses on Isthmus	558, 000. 00

REPORT ISTHMIAN CANAL COMMISSION.

MONEY STATEMENT--continued.

Appropriations--Continued.

Mar. 4, 1907. Civil administration.....	\$625,000.00
Pay officers and employees.....	\$486,000.00
Pay skilled and unskilled labor.....	50,000.00
Material and incidental expenses.....	289,000.00
Sanitation.....	2,034,000.00
Pay officers and employees.....	766,000.00
Pay skilled and unskilled labor.....	468,000.00
Material and incidental expenses.....	800,000.00
Reequipment Panama Railroad.....	1,385,000.00
Redemption Panama Railroad bonds....	2,298,367.50
Total appropriation year 1908.....	\$27,161,367.50
Total appropriations.....	79,606,568.58

Expenditures.

Construction of canal.....	\$29,782,682.00
Buildings.....	5,862,384.90
Panama waterworks, sewers and paving.....	1,217,445.52
Colon waterworks, sewers and paving.....	763,302.30
Panama Railroad advances.....	1,826,683.50
Total construction and engineering.....	\$39,452,498.22
Government of the Canal Zone.....	1,431,151.71
Buildings.....	338,101.40
Zone highways.....	499,023.70
Total civil government.....	2,318,276.81
Sanitation and hospitals.....	4,799,642.04
Buildings.....	750,565.96
Total sanitation.....	5,550,208.00
Loans to Panama Railroad.....	1,631,257.34
Purchase of Panama Railroad stock.....	157,118.24
Purchase Santa Rosa and Tivoli Hill properties.....	56,862.98
Balance due by laborers for their transportation.....	210,694.45
Bills rendered against Panama Railroad and others but uncollected.....	463,988.52
Collections from individuals and companies remitted to United States Treasurer as miscellaneous receipts.....	1,949,699.91

MONEY STATEMENT—continued.

Expenditures Continued.

Labor furnished and material sold to Panama Railroad, Republic of Panama, Commission's employees, and other allied interests	\$1,950,952.28	
Cash and uncollected bills at various hospitals.	2,312.71	
Total miscellaneous -----	6,422,906.41	
Less:		
Amount due individuals and companies for claims allowed but not paid on this date-----	\$505,375.18	
Amounts unpaid on pay rolls---	1,431,746.21	
June rolls --- \$1,290,419.14		
Prior months_ 141,327.07		
Total amount of collections made and bills rendered and included in expenditures which have been or will be deposited in United States Treasury as—		
Miscellaneous receipts-----	2,873,146.63	
Value of French material charged to the work or sold to individuals and companies which has been credited to purchase price of canal -----	648,511.65	
		5,458,779.67
Net miscellaneous -----		\$964,128.74
Total expenditures -----		48,285,110.37
Balance available July 1, 1907-----		31,323,458.21
Total -----		79,608,568.58

The foregoing tabulated statement of appropriations and expenditures shows that \$79,608,568.58 have been appropriated for the construction of the canal between the Atlantic and the Pacific oceans, and that of this amount, at the close of the fiscal year, a total of \$48,285,110.37 was expended. The project adopted by Congress was estimated by the Board of Consulting Engineers to cost \$139,705,200, exclusive of sanitation and expenses of the Zone government; the estimates submitted did not contemplate or provide for waterworks, sewers, and paving in Panama and Colon, made necessary to secure improved health conditions, nor is any provision made for the re-equipment of the Panama Railroad. Under the circumstances, the foregoing table is prepared with a view to showing the amount expended for the construction of the canal on estimates under which the Commission is operating.

Appendix J herewith is a statement of expenditures classified in accordance with the requirements of the general auditor.

In Appendix K are given the estimates for the fiscal year 1908-9.

ORGANIZATION.

In order that a clear idea may be obtained of the organization of the force employed in constructing the canal, diagrams are submitted showing the divisions and subdivisions of the work and those in responsible charge. (Plates 134 to 145, inclusive.)

Respectfully submitted.

GEO. W. GOETHALS,

Lieutenant-Colonel, Corps of Engineers, U. S. Army,

Chairman and Chief Engineer.

Hon. WM. H. TAFT,

Secretary of War, Washington, D. C.

APPENDIX A.

REPORT OF MAJ. D. D. GAILLARD, CORPS OF ENGINEERS, U. S. ARMY, MEMBER OF ISTHMIAN CANAL COMMISSION, IN CHARGE OF THE DEPARTMENT OF EXCAVATION AND DREDGING.

CULEBRA, CANAL ZONE, August 21, 1907.

SIR: I have the honor to submit the following report of operations for this department for the fiscal year:

On April 12, 1907, I was placed in charge of "dredging in the harbors, of building the necessary breakwaters, and of all excavation in the canal prism, except that incidental to lock and dam construction."

CULEBRA DIVISION.

This division extends from the point where the canal first crosses the Chagres, in the vicinity of Gamboa, to the south end of the lock site at Pedro Miguel, a total distance of 9.2 miles.

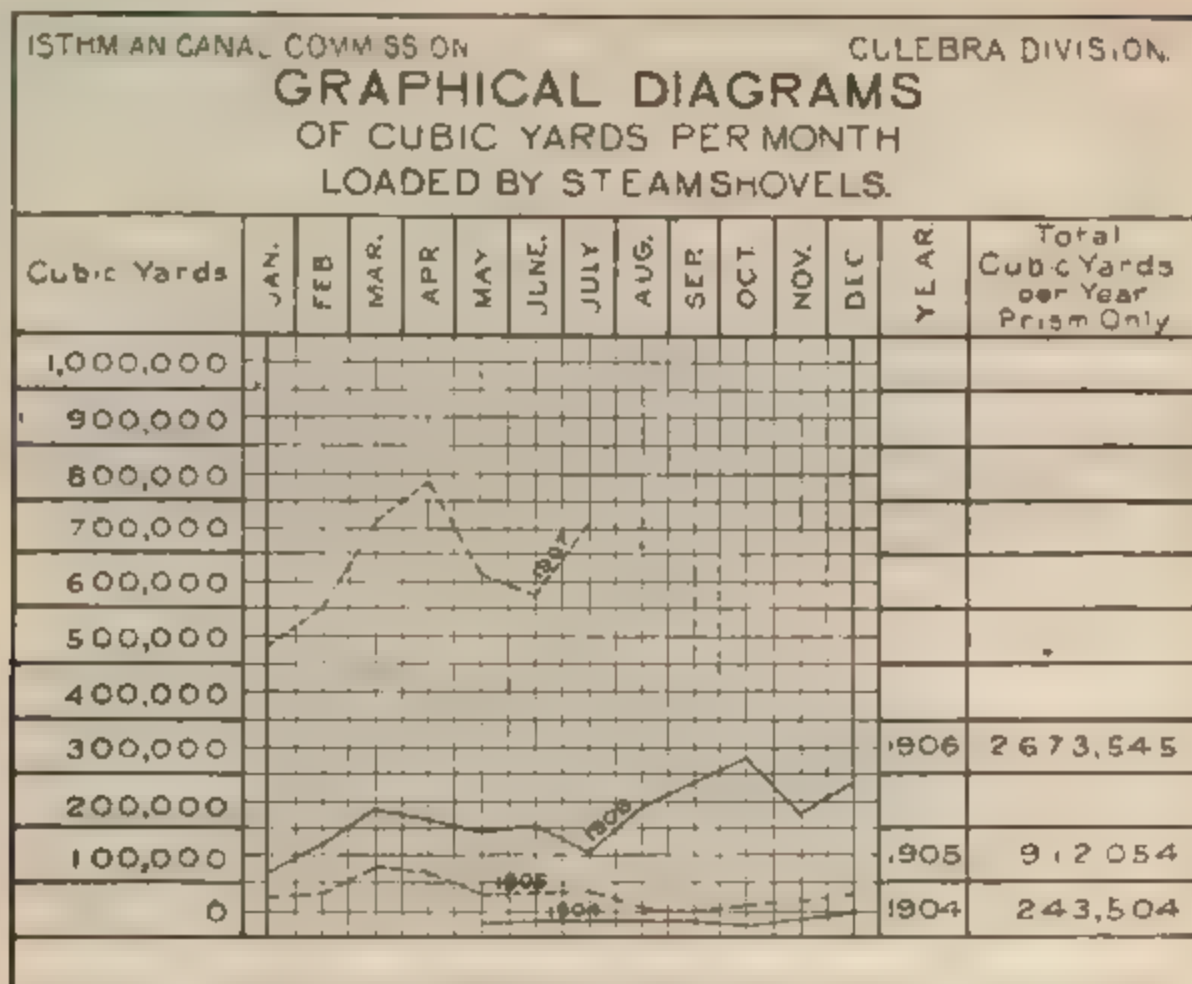
At the time of the transfer to the United States the total of all employees working for the French company numbered only about 700, and most of these were working in the Culebra division.

The total amount of material excavated in the Culebra division for the fiscal years ending June 30, 1904, 1905, 1906, and 1907 is given in the following table:

Amount of material excavated in the Culebra division since the United States assumed control (place measurement).

Fiscal year ending June 30—	From canal prism				Total excavation including canal prism and accessory works.			
	Earth	Rock	Not classified	Total	Earth	Rock	Not classified	Total
	Cu yds.	Cu yds.	Cu yds.	Cu yds.	Cu yds.	Cu yds.	Cu yds.	Cu yds.
1901			60,107	60,107			60,107	60,107
1903	327,404	230,875	183,365	741,644	327,404	230,875	183,365	741,644
1906	764,327	742,235	—	1,506,562	764,327	742,235	—	1,506,562
1907	2,288,199	3,282,233	—	5,570,432	2,413,358	3,325,613	29,043	5,768,014
Total....	3,379,930	4,265,343	243,472	7,878,745	3,500,089	4,298,723	272,510	8,076,327

The amount of material removed in the Culebra division during each month since the United States assumed control in May, 1904, is shown graphically on the accompanying plate.



In considering these tables and curves, it must be remembered that previous to January 1, 1907, much of the work done by steam shovels was of a preparatory nature and consequently the output was necessarily less than when the shovels had been established on a regular working basis. Moreover, the average number of steam shovels working during the first half of the fiscal year was only about 20, while for the last half of the fiscal year the average number was a little over 38.

Amount of material excavated monthly in the Culebra division during the fiscal year ending June 30, 1907 (place measurement).

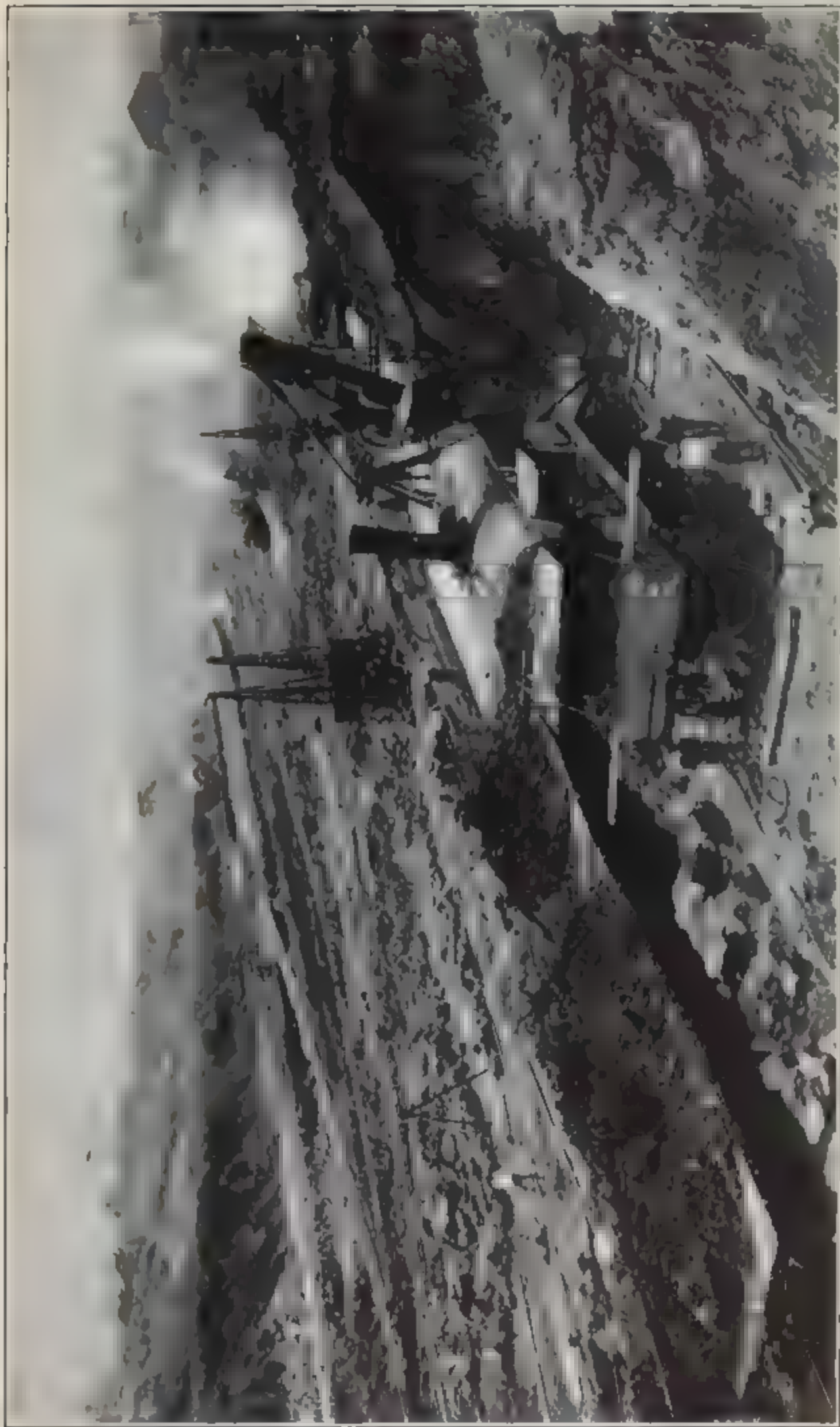
Month	From canal prism			Total excavation, including canal prism and necessary works			
	Earth	Rock	Total	Earth	Rock	Not classified	Total
	Cu yds	Cu yds	Cu yds	Cu yds	Cu yds	Cu yds	Cu yds
1906							
July	48,772	111,517	159,789	48,272	111,517		159,789
August	53,839	190,284	244,823	53,839	190,284		244,823
September	108,224	185,228	291,452	108,224	185,228		291,452
October	109,903	217,106	327,009	109,903	217,106		327,009
November	72,618	149,024	221,642	72,618	149,024		221,642
December	109,158	169,488	278,646	109,158	169,488	29,013	307,689
1907							
January	246,653	293,182	539,835	267,458	299,292		566,750
February	293,461	315,038	608,499	316,461	322,651		639,112
March	97,65	77,042	174,697	431,976	690,300		815,270
April	62,021	488,993	541,614	382,344	496,18		879,527
May	281,111	378,400	659,511	298,756	391,100		690,305
June	213,355	411,231	624,586	213,355	411,231		624,586
Total	2,288,199	3,282,233	5,570,432	2,411,358	3,325,613	29,013	5,766,014



VIEW N. CULBERTSON CUT LOOKING SOUTH, SHOWING GOLD HILL HEIGHT 600 FEET, IN THE BACKGROUND



PLATE 14.



VIEW N CULEBRA JUT NEAR EMPIRE LOOKING SOUTH

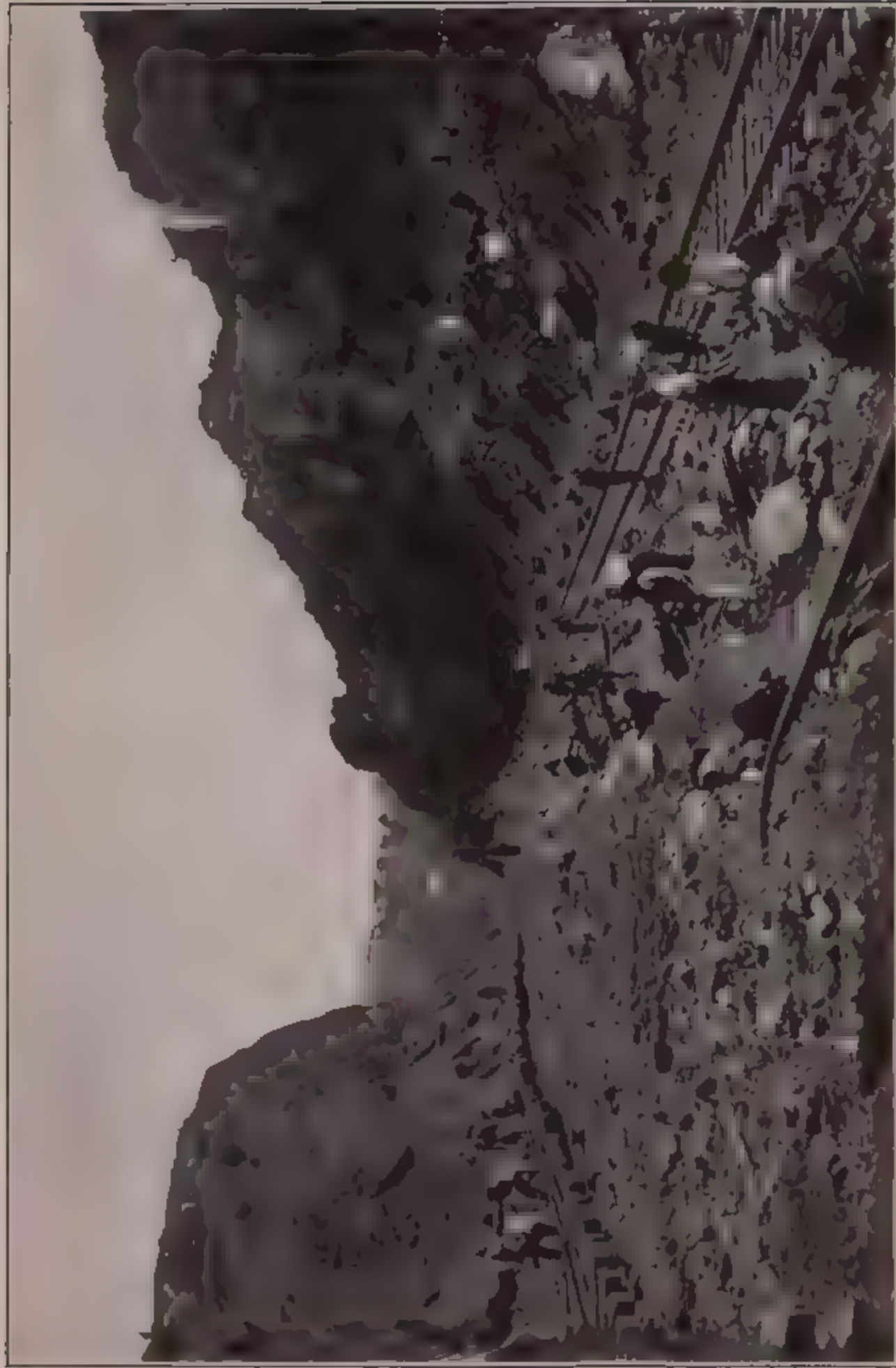




AR DRILLS AT WORK AT THE FOOT OF GOLD HILL



PLATE 16.



AIR CROLLS AT WORK IN THE CUT AT BAS OB SPO



It will be seen from the above table that the maximum monthly amount of material excavated in the Culebra division during the fiscal year was 879,527 cubic yards, which was removed in April, 1907. This amount exceeds by 75 per cent the maximum monthly excavation, as given in available records, made by the French in the Culebra division, their highest monthly total in the Culebra division being 502,250 cubic yards in February, 1886.

With the exception of a very small proportion of material removed by hand from the quarry in the canal prism at Bas Obispo, all material is handled by steam shovels and dirt trains, and is carried to dumps situated at distances varying from 1 mile to 15 miles, the average haul at present being about 10 miles.

This haul will increase in length, owing to the necessity of using material from the cut in the construction of the dams.

Blasting.—The total amount of material actually mined during the fiscal year was 3,291,856 cubic yards.

The compressed-air plant was put in operation during the month of January, and all drills are now being run by compressed air. During the fiscal year 39 well, or mechanical churn, drills, were in operation, and 139 air drills.

The number of linear feet of holes drilled during the fiscal year, were as follows:

	Lin. ft.	Miles.
Steam and air drilling.....	442,839 or	83.9
Well, or mechanical churn drilling.....	167,052	31.6
Hand drilling.....	100,101	19.0
Total.....	709,992	134.5

The quantities of explosives used during the year amounted to—

	Pounds
Dynamite.....	1,998,655
Black powder.....	408,385
A total of 1,203.5 tons.	

Steam shovels.—At the beginning of the fiscal year 39 steam shovels had been received, but a large number of them had not been put to work. Up to the end of the fiscal year, 63 steam shovels had been delivered, erected, and accepted. At present these shovels are distributed as follows:

Assigned to the Culebra division.....	52
In Empire shops for repairs.....	1
Assigned to Gatun.....	6
Assigned to Panama Railroad.....	4
Total.....	63

These shovels are of three sizes, 45-ton, 70-ton, and 95-ton, with dipper capacity of $1\frac{3}{4}$, $2\frac{1}{4}$, and 5 cubic yards, respectively.

The daily average number of shovels at work during the fiscal year ending June 30, 1906, was 9.17, and for the fiscal year ending June 30, 1907, 29.03.

The number of cubic yards excavated per hour, while under steam, by shovels not engaged in preparatory work, averaged 66 for the fiscal year ending June 30, 1906, and 86 for the year ending June 30, 1907.

The largest output during the fiscal year was made by steam shovel No. 218, a 95-ton shovel, which in 260 excavator days took out 211,055 cubic yards of rock and 42,967 cubic yards of earth, a total of 254,022 cubic yards for the year.

A table showing the performance of steam shovels in the Culebra division for the fiscal year ending June 30, 1907, follows. It must be remembered that this performance is based upon a working day of but eight hours, whereas contractors in the United States usually work their steam shovels about ten hours per day.

Performance of steam shovels, Culebra division, fiscal year ending June 30, 1907.

Month.	Number of working days.	Output per shovel.				Rainfall at—	
		Per day.	Per month.	Per hour under steam.	Per hour at work.	Empire.	Culebra.
		Cu. yds.	Cu. yds.	Cu. yds.	Cu. yds.	Inches.	Inches.
1906.							
July	25	378	9,441	51	144	13.61	20.28
August	27	535	14,461	73	144	11.44	12.97
September	24	568	13,684	79	142	7.41	6.22
October	27	582	14,873	69	142	3.97	8.46
November	24	459	10,823	66	132	21.06	19.19
December	25	491	12,267	66	132	6.15	9.09
1907							
January	36	702	18,248	95	170	.04	.00
February	23	674	15,968	96	162	.14	.49
March	25	741	18,580	100	171	.16	.08
April	26	766	19,894	104	201	.09	.04
May	26	833	21,874	111	190	6.22	7.46
June	25	651	16,268	90	162	12.54	14.74
Fiscal year	303					87.24	98.99

Transportation.—The plant in operation under the transportation department on June 30, 1907, was as follows:

Locomotives	132
Lidgerwood plows	28
Lidgerwood unloaders	18
Spreaders	12
Lidgerwood flat cars	1,245
12-yard western dump cars	267
20-yard western dump cars	86
6-yard old French dump cars	196
Ballast cars	24

In addition the track and dump department had in operation 3 track throwing machines.

At the beginning of the fiscal year there were 65.8 miles of track in operation, of which 28.1 miles were laid with old Panama Railroad and Belgian rails. At the close of the fiscal year there were 106.78 miles of track in operation in the Culebra division, which is practically all of 70-pound American steel.

Along the bottom of the canal from Culebra summit to the White House material yard there are four running tracks, and from Culebra summit to the Pedro Miguel material yard there are three running tracks. These tracks are now in a fairly satisfactory condition, although work has been considerably retarded by the slow arrival of track material, particularly material needed for switches.

Dumps.—During the fiscal year the inside dumps have been almost filled up, so that from this time forward nearly all material will have to be hauled over the Panama Railroad to Gorgona, Mamei, Tabernilla, and Gatun from the north end of the cut, and to dumping grounds on the New Panama Railroad, the Sosa-Corozal dam and La Boca from the south end of the cut.

The Tabernilla dumping ground is the largest of these dumping grounds, and in a short time this dump alone will handle about 12,000 cubic yards a day.

Yards.—The two principal yards, where material is taken from the cut and made up into trains, are at White House and Pedro Miguel. The only new yard of any size projected during the year is on the Tabernilla dump. A large yard is being installed there with the view of carrying material directly from the steam shovels instead of switching and changing engines at White House yard as at present, and it is believed that this proposed method will prove more satisfactory and economical than the method in use at present.

Labor.—The labor situation during the year has been very satisfactory, and at the present time no special difficulty is experienced in securing all the men needed in the various departments of the work. Better foremen are now being secured than in the past, and with more efficient foremen, the laborers themselves will necessarily prove more efficient.

On the Culebra division there are Spaniards, Italians, West Indian negroes, and a few negroes from the United States.

Spaniards and Italians are usually paid 40 cents per hour silver (20 cents gold), and West Indian negroes, when not furnished with meals, 20 cents per hour silver (10 cents gold). The prices just mentioned are for ordinary laborers. Firemen, drill runners, etc., receive higher wages.

The daily average number of laborers employed on the work during the fiscal year was as follows:

Installing new plant	1, 119
Blasting	708
Steam shovels.....	378
Tracks.....	643
Dumps	1, 373
Transportation	264
Engineering	58
Water service.....	81
Total.....	4, 684

The daily average number in all departments during the previous fiscal year was 2,034.

During the year the wages of the gold employees of the Culebra division have been increased 8 per cent on an average. This increase is almost wholly due to the continued prosperity in the United States, which necessitated an increase in wages in order to hold suitable men on the Isthmus.

Cost.—Considering the total output in the Culebra division for the fiscal year, the average cost of the various items of expense have been as follows:

Arbitrary, to cover cost of plant.....	\$0. 1200
Blasting .....	. 1451
Excavation by steam shovels.....	. 1081
Transportation .....	. 1942
Tracks .....	. 0830
Dumps .....	. 1548
General expense .....	. 0193
Total	*. 8245

In the table of costs just given the total cost of blasting has been distributed among the total number of cubic yards of excavation, but to get the real cost it should be applied only to the material actually mined, 3,291,856 cubic yards, making the cost for blasting \$0.2557 per cubic yard. In other words, other things being equal, the removal of rock, due to blasting alone, cost \$0.2557 more than that of earth.

The item in the table entitled "Arbitrary, to cover cost of plant," is a fixed charge added to the cost of excavation with the idea that this fixed charge added to every cubic yard of material excavated will, by the time the canal is completed, total a sum which will be equivalent to the original cost of the plant, repairs for the plant being included in the cost of operation.

The different items which go to make up this arbitrary charge of 12 cents are as follows:

Item.	Charges per cubic yard U. S. gold	Remarks.
A Steam shovels.....	\$0. 0075	Includes cost of new shovels set up ready for service.
B. Cars .....	. 0450	Includes cost of new cars.
C Engines. ....	. 0250	Includes cost of new engines and rebuilding of French engines.
D. New appliances. ....	. 0100	Includes cost of new appliances, such as unloading plows, spreaders, and unloaders.
E. Track material.....	. 0175	Includes cost of new track material
F Structures.....	. 0025	Includes cost of new structures, such as coal pockets, round-houses, powder magazines, yard offices, etc.
G Miscellaneous equipment	. 0025	Includes cost of new steam and well drills, channelers, pile drivers and other new appliances considered as working plant
H Contingencies .....	. 0100	Includes miscellaneous expenditures covering investment in plant.
Total .....	. 1200	

Up to January 1, 1907, the arbitrary charge to cover cost of plant had been 6 cents per cubic yard of material excavated, but it was believed that this would be insufficient, and a value of 12 cents per cubic yard was adopted; but it is quite possible that this may have to be increased in the future.

* This does not include the material used in the repair of locomotives, steam shovels, and cars, nor does it include the cost of operating the air compressor nor the proportionate cost of administration and general expenses of the mechanical department, which makes repairs on plant for the Culebra division. These items have never heretofore been included in the cost of excavation in the Culebra division, but as they comprise a fair charge against this work, they will be included in the cost of work for the fiscal year ending June 30, 1908.

Cost of plant.—The total amount charged to arbitraries for the fiscal year ending June 30, 1907, in the Culebra division was as follows:

Arbitrary—

A	\$576,858.16
B	2,145,792.00
C	2,088,633.17
D	176,083.79
E	679,184.28
F	14,207.59
G	83,100.58
H	8,500.41
Total	5,772,868.98

Nearly all of the large items of plant needed for the Culebra division have been already purchased and are in operation, with the exception of about 300 Lidgerwood flat cars and about 500 dump cars.

Coal consumed.—During the fiscal year 79,500 tons of coal, costing \$515,453, were used in the Culebra division. The cost of fuel is a heavy item of expense, and it is hoped that it may be to some extent reduced in the future by the use on stationary engines of crude oil, which it is now possible to obtain from the Union Oil Company of California at an agreed price of 90 cents per barrel. This company has an 8-inch pipe line extending clear across the Isthmus alongside the tracks of the Panama Railroad Company from La Boca to Cristobal.

Change in organization.—The organization which had existed during the previous fiscal year was continued with but little change during the fiscal year ending June 30, 1907, but on July 1, 1907, upon recommendation of Mr. L. K. Rourke, acting division engineer, Culebra division, a new organization was effected. The reorganization consisted in the appointment of an assistant division engineer and in dividing the Culebra division into five construction districts, each under charge of a superintendent of construction responsible for all work in his construction district. This organization affords the means of fixing the responsibility definitely and promptly in case any part of the work is not satisfactory in any one of the construction districts.

The superintendents watch their work more closely and take more personal pride in results obtained when serving in their present capacity than they did when acting as supervisors in a single large construction district.

The new organization has now been tried for over a month and a half. The output has been increased, work is progressing with less friction, and as a consequence of these facts the cost of excavation has been reduced.

The following changes were made in the organization of the Culebra division during the fiscal year:

- July 11, M. K. Jones, appointed superintendent of transportation
- July 16, Jos. Little, appointed superintendent of excavation.
- July 16, D. W. Bolch, appointed acting division engineer
- July 26, L. K. Rourke, appointed superintendent tracks and dumps.
- August 31, H. F. Dose, resigned resident engineer
- October 22, A. S. Zinn, appointed resident engineer.
- December 1, D. W. Bolch, appointed division engineer

Proposed diversion channels. The bottom of the canal, when completed, is fixed at +40 throughout the entire length of the Culebra division, a distance of 9.2 miles. As the cut becomes deeper the question of its drainage will become more difficult and especially is this the case on the northern portion of the Culebra division. At the north end of the Culebra division, where the Chagres crosses the line of the canal, the elevation of the water surface of the river at dead low water is about +44, and during the rainy season, under normal conditions, the elevation of the water surface at this point varies from about +46 to +50; but during the great flood of December, 1906, the water surface there reached an elevation of +79.9. It is, therefore, evident that when the canal is approaching completion, a barrier or dam must be placed at the northern end of the Culebra division, near the river, to keep out the waters of the Chagres, and that the larger part of the drainage of the canal must be carried to the south, where the land slopes more rapidly toward the Pacific.

It will, however, probably be necessary to install centrifugal pumps at the north end of the Culebra division at this point in order to dispose of the water which will come down into the cut and can not conveniently be carried off by natural drainage to the south. It is very important to divert from the canal, for construction purposes as well as for economy in maintenance after the canal has been completed, all possible water which would get into it from the adjacent watershed. It is therefore proposed, during the next fiscal year, to repair and put into operation the old French diversion channel extending from Culebra and emptying into the Chagres on the west side of the canal below Gamboa.

For the diversion of the waters on the east side of the canal between Culebra and Cascadas the French engineers had proposed and partially constructed a diversion channel which would receive the waters of the upper Obispo River, and would carry them across the canal on a high steel or iron aqueduct at Empire and discharge them into the diversion channel on the west side of the canal. The bottom of this aqueduct was to be at an elevation of about 180 feet above the water surface of the canal.

Another diversion channel began on the east side of the canal near the east end of this aqueduct and extended parallel to the canal to Cascadas, where the waters were carried across the canal on a second aqueduct, similar to the first, but at a lower elevation above the water surface. From Cascadas to the Chagres River no diversion channel was apparently contemplated on the east side of the canal.

During the fiscal year a survey party has been at work locating a diversion channel for the Obispo River and other streams on the east side of the canal, which will extend from Culebra and will run approximately parallel to the canal, discharging its waters into the Chagres near Gamboa at a place about a mile above the point where the line of the canal crosses the river.

It is believed that a suitable location can be secured for this diversion channel, but it has not yet been possible to estimate the cost of this work.

Remarks. During the latter part of the year 1906, the question of an increase of wages was agitated by the steam shovelmen and cranemen. The former were then receiving \$210 per month and the latter \$185 per month for eight hours work per day. The steam

shovel engineers demanded an increase to \$300 per month and the crane-men to \$250 per month. The matter was referred to the authorities at Washington, and it was decided that an increase of 5 per cent per annum should be paid to these and certain other employees at the end of one year's service and 3 per cent additional increase at the end of each succeeding year of service. This decision was unsatisfactory to a large number of the steam shovel engineers and crane-men, and between May 8 and 13 so many of them had quit work or resigned that the output fell from 33,231 cubic yards on the former date to 8,013 cubic yards on the latter date, at which time but 13 shovels were working.

By the promotion of deserving subordinates and by the return to work of some of the dissatisfied men, the force of steam shovel engineers and crane-men was gradually increased until by the close of the fiscal year things were on a normal basis and the full number of engineers and crane-men needed for the steam shovels were available.

It should be stated that during this entire affair no personal ill feeling between the officials in charge of the work and the dissatisfied employees developed, and no injury or damage whatever to persons or property resulted during the entire affair.

In comparing the cost of work upon the Isthmus with that of similar work in the United States, certain conditions existing in the former locality must be taken into consideration. The wages paid for skilled labor on the Isthmus are, on an average, from 40 to 70 per cent higher than the same class of laborers receive in the United States. Their working day here is but eight hours in length, while on private enterprises in the United States the working day is usually ten hours.

In the greater portion of the eastern and southeastern part of the United States the price of soft coal does not exceed from \$3 to \$3.50 per ton. The coal used on the Culebra division during the fiscal year ending June 30, 1907, cost \$6.48 per ton. Could this coal have been purchased for \$3.25 per ton it would have reduced the cost of all excavation in the Culebra division for the fiscal year by $4\frac{1}{2}$ cents per cubic yard.

Owing to the long distance from the source of supply, machinery and material of all classes are more expensive than in the United States.

In addition to these disadvantages, the climate is not one conducive to great physical and mental activity, and the rainfall is so heavy—averaging about 95 inches per annum for the Culebra division—that it interferes considerably with the rapid prosecution of work. This can readily be appreciated when it is remembered that the greater part of this rainfall occurs during the eight months comprising the rainy season.

CHAGRES DIVISION.

This division extends from the deep water of Lake Gatun to the point where the canal crosses the Chagres River in the vicinity of Gamboa.

No construction work had been done on this division previous to the end of the fiscal year.

A survey party was organized about the 15th of January, and has cut a line about 30 feet wide from Limon Bay nearly to mile 18, measuring accurately, and permanently marking the center line of the canal. Cross sections of the canal have been made at intervals

of 100 feet, and monuments set at all points of intersection and other controlling points on the line. This work is now proceeding satisfactorily, and will be continued to the south end of the Chagres division.

Until this survey has been completed it is not possible to tell accurately the amount of material which must be removed from the Chagres division, or to give accurately the classification of such material.

From the best data now available it is believed that the total amount of material to be removed in the Chagres division will be about 13,000,000 cubic yards, of which it is believed that a little less than one-third is rock.

The Chagres River crosses the center line of the canal 23 times within the limits of the Chagres division. As a consequence, a considerable part of the area adjacent to the center line of the canal is subject to overflow at times of high floods in the Chagres, and work in places on this division will, consequently, be liable to frequent interruption during the rainy season.

It is very desirable that all parts of the canal should be finished at about the same time, so that delay in completing any particular section of the canal would not delay the time of opening the canal to commerce. For this reason operations upon the Chagres division should be commenced at an early date in order that no doubt may exist as to the time of final completion of this section of the work.

The total quantity of material to be removed is not so large, but conditions are not favorable for the rapid prosecution of work on this division, and where rate of progress can not be foretold accurately in advance, it is well to be on the safe side.

It is expected that a division engineer, to be placed in charge of the Chagres division, will report in July, and upon his arrival he will be instructed to proceed at once to make preparations for commencing work upon this division.

COLON DREDGING DIVISION.

The Colon dredging division extends from the locks at Gatun to deep water of the Caribbean.

The estimated amount of material to be removed from this division is nearly 21,000,000 cubic yards, of which about 3,700,000 cubic yards consist of rock, and the rest of earth and mud.

It is expected that all of this material will be removed by dredging, except about 700,000 cubic yards in the vicinity of the Mindi hills, which will be removed by steam shovel.

Borings. During March a party began taking borings between the north end of the Gatun locks and Limon Bay, along the line of the canal. Thirty-two holes, having a total depth of 2,247.6 feet, in three rows 250 feet apart, have been drilled.

Mindi. Clearing for the excavation by steam shovel at Mindi was begun about June 1, 1907. The whole canal line higher than the 10-foot contour has been cleared. A switch has been set connecting with the Panama Railroad, about 300 feet of track laid, and a short trestle built. This work will be continued, and two steam shovels will commence operations in the Mindi hills early in the next fiscal year.

PLATE 17.



WELL DRILLING AT WORK ON WEST SIDE OF CANAL ABOUT ONE HALF MILE NORTH OF CONTRACTOR'S HILL



PLATE 18.



MINING WELL, 3 FEET DEEP WITH DYNAMITE ON WEST SIDE OF CULEBRA CANYON ABOUT ONE HALF MILE NORTH OF CONTRACTORS HILL





VIEW REFUGE FROM BLAST OF SEPTEMBER 29 ON WEST SIDE OF CANAL AT BAS OBISPO. FOUR HOLES DRILLED DEPTH 18 FEET, 2600 POUNDS OF BLACK POWDER USED 19640 CUBIC YARDS OF ROCK DISPLACED





EXPLOSION IN PROGRESS BLAST OF SEPTEMBER 9 1907, AT BAS OB SPO





EXPLOSION IN PROGRESS BLAST OF SEPTEMBER 19 A. J. AT BAS OBISPO





VIEW AFTER F R NG BLAST OF SEPTEMBER 19 1907, AT BAS JBSPU





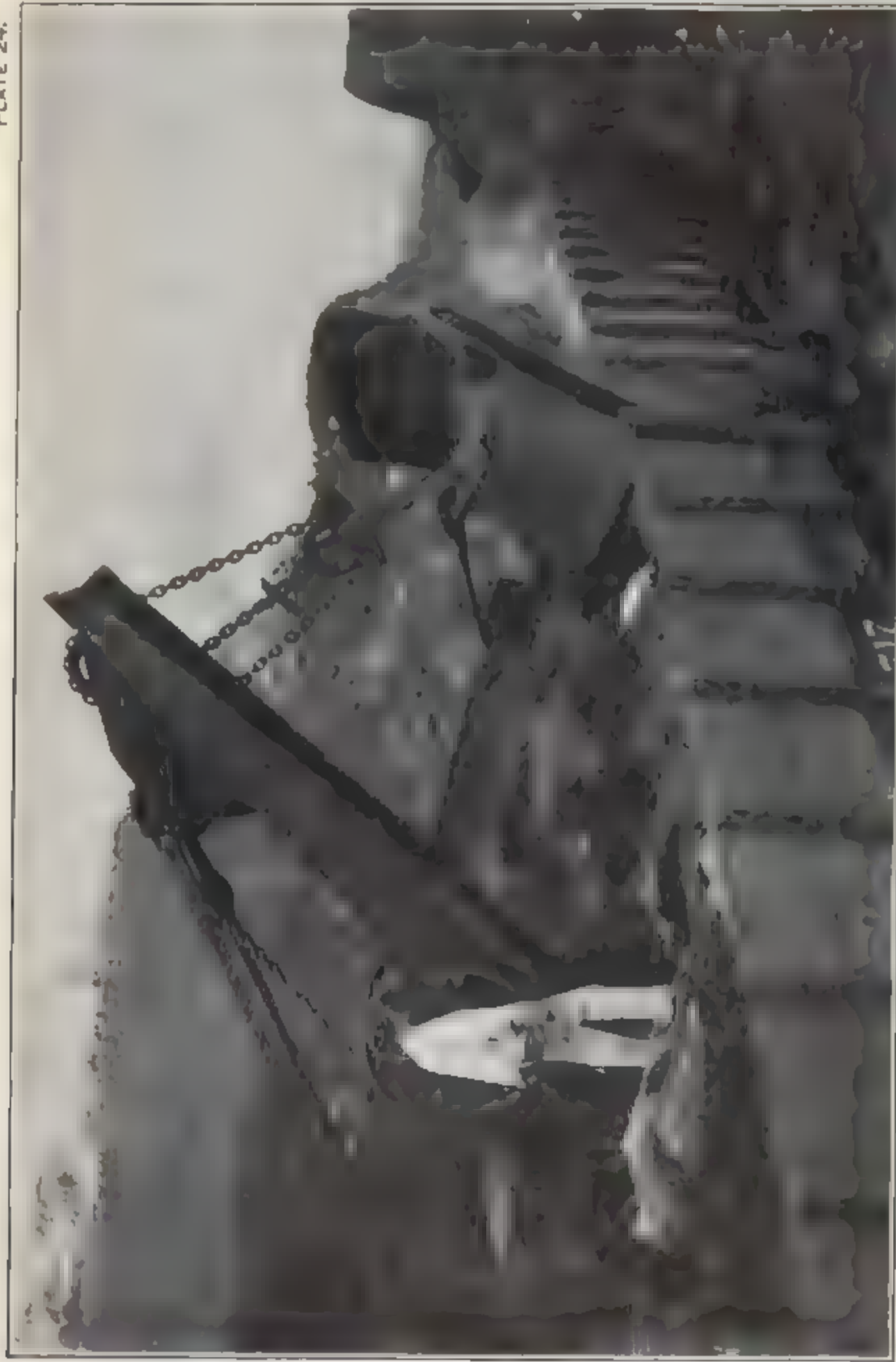
STEAM SAW IN OPERATION EAST SIDE OF CLERRA CANYON JUST SOUTH OF GOLF HILL.





STEAM SHOVEL LOADING TWELVE YARD WESTERN DUMP CARS ON WEST SIDE OF CULEBRA CUT AT CONTRACTOR'S HILL





STEAM SHOVEL LOADING TRAP ROCK INTO HOPPER CAR AT OBISPO





ROCK CHANNELER AT WORK ON 95 FOOT BERM ON EAST SIDE OF I. T. AT BAS OBISPO





LOADED LOGGERWOOD FLATS IN WHITEHOUSE YARD WHERE MATERIAL IS BROUGHT FROM THE CUT AND MADE UP INTO TRANS FOR THE DUMPS TO THE NORTH





WRECKING CRANES IN ACTION NEAR GORGONA.





DUMP AT EAST LA BOCA IMMEDIATELY AFTER HEAVY RAIN





TRESTLE DUMP JUST OUTSIDE OF EAST TOE OF THE SOSA COROZAL DAM ANCON HILL AND ANCON HOSPITAL BUILDINGS IN THE BACKGROUND





TRACK-THROWING MACHINE ON THE DUMP AT TABERNULA





THROWING TRACK BY HAND IN THE CUT AT BAS OB SPO





PLOWING OFF A TRAIN OF L. DISERVWOOD FLATS ON THE TABERNASH DUMP



PLATE 33.



DUMPING MATERIAL FROM TWELVE YARD WESTERN DUMP, ARS





SPREAD'N' MATERIAL ON THE COROZAL PUMP





SEAGOING SUCTION DREDGE ANCON TAKING ON COAL NEAR RY DOCK AT CRISTOBAL





SIXTEEN-FOOT SUCTION DREDGE WORKING IN CANAL PRISM AT MINDI





DRY DOCK AT CRISTOBAL AT BEGINNING OF WORK OF ENLARGEMENT





DRY DOCK AT CRISTOBAL THIS DOCK WILL ADMIT VESSELS NOT EXCEEDING 298 FEET IN LENGTH, 50 FEET IN WIDTH AND 15 FEET DRAFT.





FIVE YARD HOPPER DREDGE IN THE ENTRANCE CHANNEL, IN THE PACIFIC NEAR LA BOCA. THE DREDGE IS LOADING MATERIAL INTO AN OLD FRENCH SELF PROPELLING HOPPER BARGE KNOWN AS A 'CLAPET'.





OLD FRENCH LADDER OR ELEVATOR DREDGE DEEPENING ENTRANCE CHANNE IN THE PACIFIC NEAR LA BOLA THIS DREDGE IS BEING SERVED BY TWO OLD FRENCH SELF PROPELLING HOPPER BARGES KNOWN AS 'CLAPETS'.



Dredging.—At the beginning of the fiscal year dredge No. 1, an old French ladder dredge, was operating in the slip leading to the dry dock, and continued working there until August 27, removing 77,000 cubic yards, of which about 10,000 cubic yards were coral. It was then moved into the old French canal opposite the dry-dock slip for the purpose of cutting a 20-foot channel through to Boca Mindi. It was operated until about the 1st of November in the old French canal, and removed 180,447 cubic yards. The dredge was then in poor condition, and repairs to dredge No. 6 (an old French ladder dredge) being finished, dredge No. 1 was taken out of service. Dredge No. 6 began excavating in the old French canal above the dry-dock slip November 7, 1906, and has removed 490,240 cubic yards, of which 17,000 cubic yards were from the new canal prism in the Bay of Limon.

The small 16-inch suction dredge which has been used in filling low places in Colon, was moved into the old French canal, about 1 mile above the dry-dock slip on the 15th of September, and began excavating material and pumping it ashore. She continued operations in the old French canal until the end of the fiscal year, removing 279,484 cubic yards.

A new 5-yard dipper dredge, built by the Atlantic, Gulf and Pacific Company, was tested and accepted March 7, 1907, since which time the dredge has been employed in excavating in the old French canal, where there was a bed of coral, and has removed 35,102 cubic yards.

It will be seen from what precedes that much of the greater portion of material excavated by dredging during the fiscal year was taken from the old French canal, and forms no part of the material to be taken from the prism of the canal now under construction by the United States. The work was necessary for the purpose of getting material, by water, to the vicinity of the Gatun locks and dams. Without this work it would be impracticable to transport the immense amount of material needed in construction work at Gatun.

Dredging plant.—The dredging fleet now consists of one old French ladder dredge, one 5-yard dipper dredge, and one 16-inch suction dredge. The dipper dredge is fitted with a 5-yard dipper for soft material, and a 3½-yard dipper for rock, and is capable of dredging to 42 feet. The hull is of steel, 110 feet long, 38 feet wide, and 10 feet deep. This dredge cost \$102,500. There is under contract with the Featherstone Foundry and Machine Company a dipper dredge similar to that just described, which is to cost \$100,000 delivered at Colon. This dredge should reach the latter place soon after the end of the fiscal year.

A contract has been made with the Maryland Steel Company of Sparrows Point, Md., for two seagoing suction dredges—the *Ancon* and *Culebra*—similar to the *Manhattan* and *Atlantic*, now operating in New York Harbor. Each of these boats has a length of about 288 feet, molded beam 47½ feet, molded depth of 25 feet, and is propelled by twin screws. They are each equipped with two 20-inch pumps, capable of digging to a depth of 40 feet. Their hoppers have a nominal capacity of about 2,000 cubic yards. The dredges are to be delivered at Sparrows Point, Md., at a cost for the two of \$724,850, without equipment. Their hulls have both been launched, and the

Ancon is expected to arrive at Colon early in August. The *Culebra* will probably not be finished before the latter part of September, and will then commence her long trip to Panama by way of Cape Horn, but will probably not arrive at Panama before January, 1908.

The old French ladder dredge *No. 1*, which had been abandoned for a time, is again to be put into commission, and is now undergoing extensive repairs in the dry dock at Cristobal.

Under contract with the Newport News Shipbuilding Company, six steel hopper barges were constructed. Each of these barges has a capacity of about 350 cubic yards. They were to be delivered at Newport News. The barges have all been completed, and three of them are now en route to the Isthmus.

The dredges are served by the tug *Gatun*, and by four French self-propelling dump barges known as *clapets*.

The total amount of material excavated by dredging, both in the canal prism and in accessory works in the Colon dredging division, is given in the following table:

Excavation by dredges, Colon dredging division, since the United States assumed control (place measurement).

Year ending June 30—	From canal prism, soft material.	From accessory works.			Grand total, from canal prism and accessory works.
		Soft material.	Rock	Total	
	Cu. yds.	Cu. yds.	Cu. yds.	Cu. yds.	Cu. yds.
1906.....		60,700		60,700	60,700
1906..		804,645	83,500	887,545	887,545
1907.....	17,000	1,051,719	43,602	1,095,321	1,112,321
Total ..	17,000	1,916,464	127,102	2,043,566	2,060,566

Monthly excavation by dredges, Colon dredging division, fiscal year ending June 30, 1907 (place measurement).

Month.	From canal prism; soft material.	From accessory works.			Grand total.
		Soft material.	Rock.	Total.	
	Cu. yds.	Cu. yds.	Cu. yds.	Cu. yds.	Cu. yds.
1906.					
July.....		69,000		69,000	69,000
August.....		54,000		54,000	54,000
September.....		113,540	10,000	123,540	123,540
October.....		111,020		111,020	111,020
November.....		61,260	2,000	63,260	63,260
December.....		58,400		58,400	58,400
1907.					
January ..		111,100		111,100	111,100
February ..		110,002		110,002	110,002
March ..		84,145		84,145	84,145
April ..		64,000	5,889	69,889	69,889
May ..		122,974	10,873	133,847	133,847
June....	17,000	92,279	14,840	107,119	124,118
Fiscal year ..	17,000	1,051,719	43,602	1,095,321	1,112,321

Machine shop and dry dock.—The machine shop at Cristobal has been equipped with many pieces of new machinery, and is now in first-class working condition.

The dry dock adjacent to the machine shop is being enlarged and when completed will be capable of admitting any vessel not exceeding 298 feet in length, 50 feet in width, and 15 feet in draft.

LA BOCA DREDGING DIVISION.

The La Boca dredging division extends from the locks at Pedro Miguel to deep water of the Pacific Ocean, but does not include the site of the locks at Sosa.

The estimated amount of material to be removed from this division, at the close of the fiscal year, is a little over 15,000,000 cubic yards, of which about 765,000 cubic yards consist of rock and the rest of earth and mud. It is expected that all of this material will be removed by dredging, rock being blasted and then removed by a dipper dredge.

Surveys.—Cross sectioning of the canal was completed January 20, 1907, and tracings of the same made west of the canal axis between Pedro Miguel and Miraflores; 390,000 linear feet of survey lines were completed along the Rio Grande and canal axis below Pedro Miguel. On June 17, 1907, a party commenced sounding and marking the new channel, and estimating quantities and areas to be excavated in order to determine the difference between scow measurement of dredged material and measurement in place.

Borings.—In October, 1906, 11 test borings were made in the channel west of Naos Island to 40 feet below low water of spring tide, and no rock was encountered. This completed the borings in the new channel in the Pacific Ocean. In all, 372 borings, aggregating 6,372 linear feet, have been bored up to date in the La Boca dredging division, exclusive of those taken upon the sites of the locks and dams.

Dredging.—The new 5-yard dipper dredge, similar to those ordered for the Colon dredging division, was accepted and commenced operations at noon May 20, 1907, in the channel in the vicinity of the wharf. From May 20 to June 30 it was operated 22 working days, during which time it excavated 22,300 cubic yards of material.

The great range of tide in Panama Bay, reaching 20 feet at times, interferes with the rapid working of a dipper dredge, as the spuds have to be changed so frequently. A dredge of this type is necessary for the removal of the rock found in the vicinity of the lock site, but for the removal of soft material from a depth exceeding 40 feet, and in the localities where the tidal range is so great, a dredge of this type is inferior to the elevator (ladder), or the suction dredge, and the cost per cubic yard of material removed is considerably greater in the case of the dipper dredge than in that of the other two types of dredges mentioned.

The old French ladder dredge (.12) was operated both day and night until June 8, 1907, in the old French channel and in the vicinity of the wharf. This work was necessary in order to maintain the requisite depth in the old French channel, which is the only one by which vessels can approach the wharves of the Panama Railroad at La Boca. This work is therefore classed as "accessory work," since none of this material was removed from the prism of the adopted canal. From June 8, 1907, to the end of the fiscal year this dredge operated in the new channel to the west of Naos Island, and all of the material thus removed was taken from the canal prism.

This dredge (12) spent 5,832 hours during the fiscal year in actual dredging; 501 hours undergoing repairs due to breakdowns; 966 hours in placing plant, changing crews, and other delays chargeable to dredging operations; 168 hours' delay were caused by passing ships, storms, and delays not chargeable to operation, and 1,293 hours were due to Sundays and holidays.

A total of 1,213,597 cubic yards of soft material, place measurement, was removed by this dredge during the fiscal year, and the total cost of repairs, supplies, and wages of crews amounted to \$125,463.95, making the cost per cubic yard of material removed for operation of dredge about 10½ cents.

The cost of dredging in this locality would be much cheaper were it not for the high price of coal—which costs \$7.50 a ton delivered on board the dredges. The salaries paid the crews are also higher than are those paid for similar work in the United States. When these facts and the great tidal range are taken into account the figures given do not appear excessive.

Dredging plant.—The dredging fleet on the La Boca dredging division now consists of one old French ladder dredge and one 5-yard dipper dredge. A second old French ladder dredge is now being repaired and will probably be put in commission about October 1, 1907. A seagoing dredge—the *Culebra*—of the same type as the *Ancon*, which has already been described in the Colon dredging division, will be completed about October 1, 1907, and will make the trip around Cape Horn under her own steam, probably arriving at Panama sometime in January, 1908.

The ladder dredges and dipper dredges will be served by seven old French self-propelling dump barges ("clapets"), and by three steel-hopper barges of a capacity of about 350 cubic yards each. The hopper barges are now under contract and will not arrive on the Isthmus for several months.

The total amount of material excavated by dredging, both in the canal prism and in accessory works in the La Boca dredging division, during the fiscal year is given in the following table:

Excavation by dredges, La Boca dredging division, since the United States assumed control (place measurement).

Year ending June 30—	From canal prism, soft material.	From accessory works, soft material	Grand total, canal prism and accessory works.
	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>
1905		50,676	50,676
1906		1,028,914	1,028,914
1907	64,352	1,171,545	1,235,897
Total	64,352	2,251,135	2,315,487

PLATE 41.



TOR DREDGE WHICH IS BEING PUT IN C

Monthly excavation by dredges, La Boca dredging division, fiscal year ending June 30, 1907 (place measurement).

Month.	From canal prism, soft material.	From accessory works, soft material.	Grand total, canal prism and accessory works.
	<i>Cu. yds.</i>	<i>Cu. yds.</i>	<i>Cu. yds.</i>
1906.			
July		98,400	98,400
August		111,930	111,930
September		105,780	105,780
October		97,170	97,170
November		92,988	92,988
December		90,528	90,528
1907.			
January		94,710	94,710
February		93,480	93,480
March		92,319	92,319
April		104,855	104,855
May		122,157	122,157
June	64,352	67,228	131,580
Fiscal year	64,352	1,171,545	1,235,897

Machine shop.—The machine shop at La Boca is now fairly well equipped for marine work, and has accomplished much useful work in rebuilding and repairing floating equipment, such as “Clapets,” launches, water boats, lighters, pontons, electric cranes, etc.

Changes in organization.—Prior to February 1, 1907, this division was under the immediate charge of Mr. Wm. Gerig, division engineer. Since that date it has been under the immediate charge of Mr. W. G. Comber, division engineer.

Respectfully submitted.

D. D. GAILLARD,
Major, Corps of Engineers, U. S. Army,
Member Isthmian Canal Commission,
In Charge Department Excavation and Dredging.

Lieut. Col. GEORGE W. GOETHALS,
Corps of Engineers, U. S. Army,
Chairman and Chief Engineer, Isthmian
Canal Commission, Culebra, Canal Zone.

APPENDIX B.

REPORT OF THE HEAD OF THE DEPARTMENT OF LOCK AND DAM CONSTRUCTION.

Critania, August 21, 1907.

Sir: I have the honor to submit the following report of work done in connection with the construction of the locks and dams, Isthmian Canal, during the fiscal year ending June 30, 1907:

GATUN LOCKS.

During the last week of September, 1906, one steam shovel was installed and begun excavation in the site for the locks: a second shovel began operations late in October, a third the middle of February, and a fourth on March 12, 1907. A total of 484,362 cubic yards, place measurement, have been excavated by these shovels. A part of this material was placed on dump outside the prism and a part along the foot of the upper slope of the dam.

Plate 42, attached, shows the status of this work at the end of the year.

Forty-five test holes having a total depth of 4,567 feet have been made in the lock site, and 5 test pits, 6 by 5 feet, well distributed, have been sunk to the foundations for the walls. Based upon this data, a board of consulting engineers, appointed by the Secretary of War, reported on May 18, 1907, that these foundations were suitable.

The topographical survey of the quarry property and the site of the proposed reservoir dam at Porto Bello has been completed. Maps of these surveys were made on scale of 1-200 and placed on file. In this work about 17 acres were cleared and 138,000 feet of line run.

Drawings and specifications for rock crushing and power plant at Porto Bello and for 12 steel barges to be used in transporting stone and sand have been completed. Bids have been requested for furnishing such plant. Studies are in progress on plant for building the locks. Plans have been prepared for a stern-wheel steamboat for towing in the old French canal and for a concrete reservoir dam at Porto Bello.

The designs of the locks were well under way at the end of the year. The Commission had decided the types and number of gates, the method of filling and emptying the locks, and had determined tentatively to adopt the swing-bridge type of dam for emergency use in closing the locks in case the gates should be carried away. The structural designers had progressed far enough with the designs for the ordinary mitring gates and for rolling gate of same general type as those in use on the Ohio River, to show that no unusual practice will be necessary in fitting either general design to the cases in question. The design for the movable bridge dam has been developed enough to promise a satisfactory solution.

GATUN DAM.

About 573 acres of the site of this dam have been cleared, and a pile trestle has been located along the 30-foot contour on the north side of the dam, driving of piles therefor having been started early in June. At the end of the year 38 bents, or 105 piles, were driven, and carpenter work, placing caps and stringers, was well under way.

A small pump and boiler was erected at Gatun, to be used for sluicing down the material which had been dumped in the dam. Sluicing was begun in May, and at the end of the year about 14,000 cubic yards had been removed.

Contracts have been entered into for two 20-inch pipe-line suction dredges for use in construction of the lower portion of the dam. Topographical surveys are being made with a view of developing the possibility of sluicing suitable material from the top of the adjacent hills into the dam. Preparations have been made for closing out the old Chagres channel and for preparing a place within which to pump material as soon as the pipe-line dredges are available.

Plate 43 shows the work of closing the old Chagres channel. A drawing showing a typical section of this dam is attached. (Plate 146.)

SPILLWAY.

Six holes, having a total depth of 2,070 feet, have been made in the spillway site, and one test pit 6 by 8 feet sunk below the bottom of the foundations. These foundations have been declared suitable by a board of consulting engineers.

During the month of April one steam shovel commenced work on the spillway. To date it has completed the grading for a pilot track along the center line for the entire length of the excavation—about 3,600 feet—and, in addition, has excavated 3,832 cubic yards of material from the spillway, which was dumped along the south toe of the dam. The wet weather caused much trouble in starting and maintaining these dumps. Another shovel has been placed on this work, but was not in commission at the end of the year.

Plate 44, attached, shows the status of the spillway excavation at the end of the year.

The topographical survey of the country to be covered by the Gatun Lake was practically completed at the end of the year, only about ten days' work remaining to be done. The area of this lake has since been determined to be 164.23 square miles. This work has been quite extensive, 8,989,445 linear feet of line having been run and 72,000 feet of trail cut.

PEDRO MIGUEL LOCKS AND DAM.

Fifty-seven test holes, having a total depth of 4,162 linear feet, have been made in the lock site, and two test pits, 6 by 8 feet, have been sunk below the foundations for the walls. The board of consulting engineers referred to above reported that these foundations were suitable.

In January 850 cubic yards of material were excavated and transported to temporary dumps. After that date the excavation was turned over to the Culebra division, it being more economical for

that division to do a certain amount of this work in connection with adjacent excavation.

The total excavation from the lock site during the year was 162,094 cubic yards.

At the end of the year explorations by means of test pits and holes were under way, with a view of determining the feasibility of joining these locks for their guide walls to the hills on either side by short concrete dams, and thus avoid the construction of an earthen dam.

LA BOCA LOCKS.

On the lock site 92 holes were bored, aggregating 2,352 linear feet, 1,232 feet of which were wash borings and the remaining 1,120 feet diamond-drill borings in trap rock. A hard trap-rock foundation was found upon which to build the locks.

Railway tracks were located on the south face of Sosa Hill, and a steam shovel was started on August 20 on the excavation of the lock site. Five hundred and thirty-eight cubic yards of trap rock were excavated.

Prepared profiles and requisitioned necessary material for trestle needed in making a construction yard on both sides of the locks.

The general design of these locks is nearing completion, the Commission having passed upon all essential points.

The conclusions as to types of gates and movable dam above the locks, if one be built, are the same as in the case of the Gatun locks.

Preliminary investigations showed indications of sand suitable for concrete at Chorera Beach, but after a detailed survey of about 6 miles of coast it was developed that suitable sand was insufficient in quantity. Surveys are now being prosecuted at Chamie Point, 22 miles from La Boca, with good prospects of an abundant supply. Plans and specifications for six seagoing steel barges for transportation of sand have been prepared and bids requested for building and furnishing such barges.

LA BOCA-SAN JUAN DAM.

A survey was made of the site of this dam, and 54 holes, aggregating 4,623 linear feet, were driven during the fiscal year. Brush has been cleared from 28.39 acres of ground. Removed 1,850 cubic yards of material from the face of San Juan Hill in developing a suitable connection between the dam and the hill.

SOSA-COROZAL DAM SITE.

The total area of this dam site is 181.35 acres. During the fiscal year the site was surveyed, cleared, and grubbed; 29.84 acres were cleared in the area to be dredged for a pumping basin.

Fifty-five holes, aggregating 3,587 linear feet, had been bored on this site to date for the purpose of determining the character of the underlying material.

The approved plan for the dam contemplates an extensive supporting fill at each toe made of the waste material (largely stone) from the Culebra cut. In developing these dumps a trestle has been started along the east toe, commencing at the north end. Plans for a



EXCAVATION FOR LOCK SITE AT GATUN AUGUST 30 1907.





CLOSING OF THE CHAGRES RIVER AT GATUN



PLATE 44.



EXCAVATION FOR SPILLWAY AT GATUN.





SOSA COROZAL DAM STATUS OF WORK SEPTEMBER 7, 1907



trestle along the west toe of this dam were made and the necessary material requisitioned.

Two 20-inch pipe-line suction dredges are under contract for use in the construction of this dam and of the La Boca-San Juan dam. All preliminary preparations necessary are being made, so that these dredges can be placed at work as soon as delivered.

Plate 45 shows status of this work at the end of the year.

SPILLWAYS.

Completed 119 test borings for foundation for a temporary spillway on north side of Sosa Hill.

Completed the surveys through the saddle adjoining San Juan Hill to the west with a view of developing a suitable permanent spillway site.

DRAINAGE DITCH.

This ditch is intended to drain the swamp east of the Sosa-Corozal Dam and extends from this dam through the swamp between Ancon and Sosa Hill to the sea. It is 9 feet deep and 20 to 25 feet in width. Actual excavation commenced about March 1, 1907. Dredge is now about 300 feet beyond the gravel pike and working inland. In all, about 11,300 cubic yards, place measurement, have been excavated, most of which required blasting, as a rock ledge was encountered from 2 to 5 feet below the surface. During the first seventeen days of June the dredge was laid up for repairs.

One hundred and seventeen holes, aggregating 1,557 linear feet, have been bored on this site to date.

MISCELLANEOUS.

In addition to the surveys and maps of the sites of the locks, dams, and spillways, maps were made showing private property lines in the vicinity of La Boca, buildings to be removed for lock construction, sites for quarters and labor camps, sites for new machine shops and dry docks, East La Boca town site, diversion east of the Panama Railroad from Miraflores to Panama, property in the vicinity of Biablo Hill, profile of borings along the Panama Railroad from Ancon Hill south.

In connection with the surveys and examinations incident to this map work 669 holes, having a total depth of 22,248 linear feet, were driven.

The rainfall for the year at La Boca was 63.16 inches.

METEOROLOGY.

Three meteorological stations were in operation at the end of the year at Naos Island, Ancon, and Bas Obispo. A fourth station was authorized at Cristobal and will be placed in operation July 1. Eight rain-gauge stations were in operation during the year. Regular weather observations are made at all stations, and in addition special observations are made at Ancon of seismic disturbances and at Bas Obispo of evaporations; also tabulations of hourly values of wind,

velocity and direction at Naos and Bas Obispo, and records of tides and special observations of air and water temperatures for the Department of Ocean Meteorology of the United States Weather Bureau are made at Naos.

RIVER HYDRAULICS.

The work done under this head has for its object the prediction of freshets and the determination of the amount of water per year that would enter the lakes of the Isthmian Canal, together with the expected loss of water due to evaporation.

At Alhajuela continuous rain gauge and fluviograph observations were made from October 13, 1906, to June 30, 1907. Similar observations were made at Gamboa and Bohio during the entire fiscal year. These observations, however, were not sufficient to determine the maximum annual amount of water entering the lakes. And in April, 1907, gaugings of the Trinidad and Gatuncillo rivers were started, and a station was established at Gatun for the purpose of measuring the discharge through the several channels at that point; the plan being to establish fluviograph stations at Gatun on the upper Trinidad and on the Gatuncillo River, from which it is hoped to get a relation between the total flow entering the Gatun Lake and that passing down the Chagres at Bohio, at which latter station records are in existence covering a long period of time. The short time available, however, within which to determine this relation has led to the conclusion that the watersheds of the two lakes should be developed for the purpose of determining in another way, as a check, the amount of water that should enter the lakes. This information is essential in the design of the spillways.

Very respectfully,

WM. L. SIBERT,

*Major, Corps of Engineers, U. S. Army,
Head of the Department of Lock and Dam Construction.*

Lieut. Col. GEO. W. GOETHALS,
*Corps of Engineers, U. S. Army,
Chairman and Chief Engineer, Isthmian
Canal Commission, Culebra, Canal Zone.*



PAY CAR ON GATUN DAM SITE



APPENDIX C.

REPORT OF THE HEAD OF THE DEPARTMENT OF MUNICIPAL ENGINEERING, MOTIVE POWER AND MACHINERY, AND BUILDING CONSTRUCTION.

SEPTEMBER 24, 1907.

SIR: I have the honor to forward herewith report of operations and expenditures of the department of municipal engineering, motive power and machinery, and building construction, for the fiscal year ended June 30, 1907.

Very respectfully,

H. H. ROUSSEAU,
*Head of Department of Municipal Engineering,
Motive Power and Machinery, and Building Construction.*

Lieut. Col. GEO. W. GOETHALS,
Chief Engineer.

CULEBRA, CANAL ZONE, June 30, 1907.

DIVISION OF MUNICIPAL ENGINEERING.

The work performed by the division of municipal engineering during the fiscal year ended June 30, 1907, may be divided into two classes:

Class 1, work done outside of the Canal Zone, in the cities of Panama and Colon, in laying pavements and constructing waterworks and sewerage systems.

Class 2, work done in the Canal Zone, consisting of paving, road making, grading, construction of waterworks and sewerage systems, and miscellaneous work of a similar nature.

The total expenditures in this division for the fiscal year amounted to \$1,741,953.90, which was about equally divided between the above two classes.

The general plan of the work covered by class 1 has been described in previous annual reports of the Commission, and the work during the present fiscal year covered by this report, under class 1, has been in continuation of the general plan adopted at the outset of American occupation of the Isthmus—to take such steps as were considered necessary to construct such works of sanitation as were deemed best for the protection of the lives of the employees of the Canal Commission, as provided by Article VII of the treaty between the United States and the Republic of Panama. This article of the

treaty requires that all expenses incurred by the United States for work under class 1, above, shall be repaid, together with all interest charges, through the collection of such water rates as will reimburse the United States within a period of fifty years. The cost of these improvements in the cities of Panama and Colon for work approved to date will approximate \$1,750,000, and contracts have been prepared and were entered into shortly after the expiration of the fiscal year authorizing the United States to collect such water rates as will be sufficient to reimburse it for this amount, which includes all expenses for water systems, sewerage systems, and pavements in the cities of Panama and Colon. While these improvements have been paid for out of funds appropriated for the construction of the canal, inasmuch as the United States will be reimbursed therefor the cost of the canal should be credited accordingly. The value of these improvements to the cities of Panama and Colon, which have placed them on a par with cities of the first class in the United States in these respects, can not be overstated. There has been a remarkable increase in the value of real estate in both cities. The saving of lives of the inhabitants due to the improved sanitary conditions can be placed in the hundreds. The standard of living of the inhabitants has been appreciably raised, and their moral and physical welfare has been greatly promoted.

Expenditures under class 2 have been made entirely for improvements in the Canal Zone, necessary for construction work and the health and convenience of Commission employees.

The work covered by the above two classes is described in detail as follows:

PANAMA WATERWORKS.

At the commencement of the fiscal year the waterworks system of the city of Panama can be said to have been completed. During the year extensions have been made, mainly 4-inch lines, in the outlying districts of Cocoa Grove, Calidonia, and Guachapali. The sanitary department, which requested these latter extensions, estimates that this improvement has lessened its expenses at least \$15,000 per annum. The extensions are finished, with the exception of one short one on Jose Higinio street.

The following table shows the condition of waterworks within the city of Panama at the close of the fiscal year:

	Prior to July 1, 1900.	July 1, 1900, to July 1, 1907.	Total July 1, 1907.
Cast-iron water pipe:			
4-inch.....linear feet.....	629.0	8,175.1	8,804.1
6-inch.....do.....	36,402.0	4,150.4	40,552.4
8-inch.....do.....	5,381.3	677.0	6,058.3
10-inch.....do.....	1,444.5		1,444.5
12-inch.....do.....	1,443.3		1,443.3
16-inch.....do.....	1,235.0		1,235.0
20-inch.....do.....	00.0		00.0
	46,595.1	13,002.5	59,597.6
House connections.....	1,275	818	2,093
Water meters.....		1,048	1,048
Hydrants.....	78	55	133
Water cranes.....	5	2	7
Public taps.....	20	15	35

The quality of water as regards freedom from bacteria causing disease is remarkable. The consumption of water per capita has increased to about 20 gallons per day.

PANAMA SEWERAGE SYSTEM.

At the commencement of the fiscal year the sewerage system of Panama was complete with the exception of one or two minor details. During the year these were completed, and the following table shows the condition at the close of the fiscal year:

	Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total July 1, 1907.
Vitrified sewer pipe:			
6-inch.....linear feet..	1,275.0	925.0	2,200.0
8-inch.....do.....	26,946.2	9,057.8	36,004.0
12-inch.....do.....	14,659.7	1,604.1	16,263.8
15-inch.....do.....	5,037.9	453.0	5,490.9
16-inch.....do.....	127.0	.....	127.0
18-inch.....do.....	4,973.1	192.1	5,165.2
24-inch.....do.....	580.6	.....	580.6
Concrete storm sewers.....do.....	53,599.5	12,232.0	65,831.5
Manholes.....do.....	221	2,096.2	2,096.2
Catch basins.....do.....	165	02	261
			227

In addition to the sewer system as it was planned there have been two large storm-water sewers built for the purpose of draining the area of Cocoa Grove and Panama Railroad yards. These are concrete sewers and are built for the exclusive purpose of taking care of storm water flowing from an area of about 35 acres.

PANAMA PAVING.

At the commencement of the fiscal year paving had been completed on Central avenue from the Panama Railroad station to and around Cathedral plaza and work was under way on adjoining streets. All brick paving in the city was completed on April 3, 1907. All paved streets have been made of sufficient width for the passage of two teams. The following table shows in detail the work accomplished during the year:

	July 1, 1906.	July 1, 1906 to July 1, 1907.	Total.
Grading.....cubic yards..	13,021	21,725	34,746
Concrete foundation.....square yards..	33,114	9,056	42,170
Concrete curb.....linear feet..	20,285	29,066	49,351
Brick pavement.....	15,486	11,963	27,449
	38,900	26,177	65,077
Macadam foundation.....square yards..	2,307,760	1,922,297	4,230,057
Macadam pavement.....linear feet.....	6,342	16,565	22,907
Macadam pavement.....square yards..	.....	1,469	1,469
Pavement regouted.....do.....	1,646	6	1,652
Concrete pavement.....do.....	28	19,088	19,116
Sidewalks.....do.....	40	25	65

At the close of the fiscal year paving in Panama on existing streets had been practically completed. There remained to be laid pavements in some of the suburban settlements, and in addition the

necessity will soon arise for the laying out of additional streets in the city of Panama proper. All work of this character necessary for sanitation and for which the Government of Panama cares to assume the amortization cost will be taken up as the necessity develops.

COLON WATERWORKS.

A description of the waterworks system in Colon may be found in last year's report. This system is practically complete. During the fiscal year covered by this report the following pipe was laid:

	Feet.
24-inch pipe.....	2,000
4-inch pipe.....	1,678
6-inch pipe.....	24
8-inch pipe.....	254

The following service connections were made:

House connections.....	755
Service boxes installed.....	414
Meters tested and set.....	122

COLON SEWERAGE SYSTEM.

The sewerage system west of D street comprises the city of Colon, as built up, and was completed during the fiscal year ending June 30, 1907.

The following work has been done:

Vitrified pipe.	Linear feet.	Cast-iron pipe:	Linear feet.
6-inch.....	16,444	6-inch.....	1,563
8-inch.....	2,172	8-inch.....	66
10-inch.....	1,941	12-inch.....	644
12-inch.....	1,440	Galvanized pipe:	
15-inch.....	65	20-inch.....	16
18-inch.....	170		

On cross drains there has been laid 583 linear feet of 15-inch, 138 linear feet of 18-inch, and 656 linear feet of 20-inch vitrified pipe; 16,900 cubic yards were excavated and 62 concrete manholes made.

SUMP.

The sump, into which all sewage flows, was completed during the year. It is 27 feet square and 21 feet 6 inches deep. It is provided with two 8-inch centrifugal pumps which were placed in commission shortly after the end of the fiscal year. They discharge through 1,115 feet of 10-inch cast-iron pipe to a drainage ditch leading into Manzanilla Bay. House connections and the installation of modern plumbing in all dwelling houses in Colon, as required by the sanitary regulations, was in active progress at the end of the fiscal year by the owners of the houses. The filling in of land by the lessees of the land in Colon was carried rapidly forward during the year, and this work should be completed early in 1908. This work is rapidly revolutionizing the appearance and sanitary condition of Colon.

COLON PAVING.

Preliminary work was started on July 20, 1906, under difficulty, as the rainy season was at its height. The laying of sewers was followed closely by paving gangs, at times the sewer workers being only 400

feet ahead of the pavers. As the work progressed the 10-inch main had to be lowered 1 foot for a distance of 700 feet. The work was completed on September 23 and Front street opened for traffic on September 26, 1906. The following tabulation shows brick pavement laid in Colon:

Brick pavement.....	square yards..	9,031
Curb.....	linear feet	3,211
Header for brick pavement curb.....	do..	2,910
Excavation.....	do	2,500

The following is a summary of work on Colon streets during the fiscal year:

Combination curb and gutter.....	linear feet..	36,993
Macadam.....	square yards..	43,104
Earth fill.....	cubic yards..	15,253
Grading.....	do	2,218
Excavation for curb trench.....	linear feet..	15,500
Concrete header constructed.....	do....	7,965

SURFACE DRAINAGE, COLON.

Sixteen-inch galvanized-iron pipe was laid on Eleventh street, from Bolivar to the beach; Ninth street, from Front to the beach; Seventh street, from Front to the beach; Fifth street, from Front to the beach. In addition, the following vitrified pipe was laid on macadamized streets: Six-inch pipe, 120 feet; 8-inch pipe, 502 feet; 10-inch pipe, 130 feet; 12-inch pipe, 112 feet; 15-inch pipe, 931 feet; total, 1,795 feet.

ROADS, ANCON AND VICINITY.

Shortly after July 1, 1906, the Sabanas road was completed, its crusher removed to quarry near Detention Hospital, Ancon, and road built from Panama Railroad station to the Tivoli Hotel. Road construction has gone on throughout the year in the vicinity of Ancon, and roads have been laid out and graded for the new town at Sosa and East La Boca. Following is a detailed table:

Roads constructed.	To July 1, 1906.	To July 1, 1907.	Total.
	<i>Linear feet.</i>	<i>Linear feet.</i>	<i>Linear feet.</i>
La Boca road.....	6,200		6,200
Sabanas road.....	10,870	1,145	12,015
Caldonia road.....		1,972	1,972
Tivoli road.....		2,700	2,700
Section road.....		1,225	1,225
Garbage road.....		1,183	1,183
Ancon road.....		3,530	3,530
Cemetery road.....		7,920	7,920
Murphy's road.....		635	635
Tuberculosis Ward road.....		873	873
Governor's road.....		1,300	1,300
Gobler's Knob road.....		125	125
Total.....	23,070	23,733	46,803

ANCON WATERWORKS.

At the commencement of the fiscal year the new system was practically complete throughout the grounds, water being supplied temporarily from the old French pumping plant. During the year a pumping system has been installed. This consists of two 8½ by 10 by 12 duplex pumps, supplying a 50,000-gallon elevated steel tank on Ancon Hill, and a boiler plant consisting of two 125-horsepower boilers. From this boiler plant, which is located near the railroad, steam is led to the Tivoli Hotel, the Ancon laundry, Ancon Hospital, and the pumps. The tank to which these pumps operate has an elevation above sea level of 265 feet. This is known as the "high-service system of Ancon." It is by-passed by one valve into the low-service system, serving Ancon section and Tivoli, so in case of fire the pressure of the lower system can be increased by about 100 pounds, thus furnishing ample fire protection to the sections in question.

During the year there has also been installed, and will be in operation during the early part of July, a filtration plant, filtering water through sand beds under pressure. It has a capacity of 1,500,000 gallons per twenty-four hours, and will furnish filtered water to Panama, Ancon, Tivoli Section, and La Boca.

The following table shows the condition of the Ancon waterworks:

		Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total, July 1, 1907.
Cast-iron water pipe				
4-inch ^a	linear feet		535	535
4-inch	do	1,608	5,120	6,728
6-inch	do	5,261	5,005	10,266
8-inch	do	1,774	128	1,902
20-inch ^b	do	2,000		2,000
		10,753	10,788	21,541
Wrought-iron water pipe				
1½-inch	do		330	330
2-inch	do		400	400
2½-inch	do		235	235
3-inch	do		1,300	1,300
3½-inch	do		4,570	4,570
4-inch	do		264	264
6-inch	do		479	479
			7,638	7,638
House connections		60	56	106
Hydrants		25	11	36
Waste valves			34	34
STEAM LINES				
Wrought-iron pipe.				
1½-inch	linear feet.		105	105
2-inch	do		350	350
3-inch	do		585	585
4-inch	do	786	60	846
6-inch	do	298	30	328
		1,084	1,130	2,214

^a Old French 10-foot

^b Distributing line.



NORTH AVENUE AT MARKET, PANAMA BEFORE PAVING, JANUARY 1907





CATHEDRAL PLAZA PANAMA BEFORE PAYING MARCH, 1906





CATHEIRA PLAZA PANAMA AFTER PAYING AUGUST 1907.



PLATE 51.



TWELFTH STREET, PANAMA, BEFORE PAVING FEBRUARY 1907





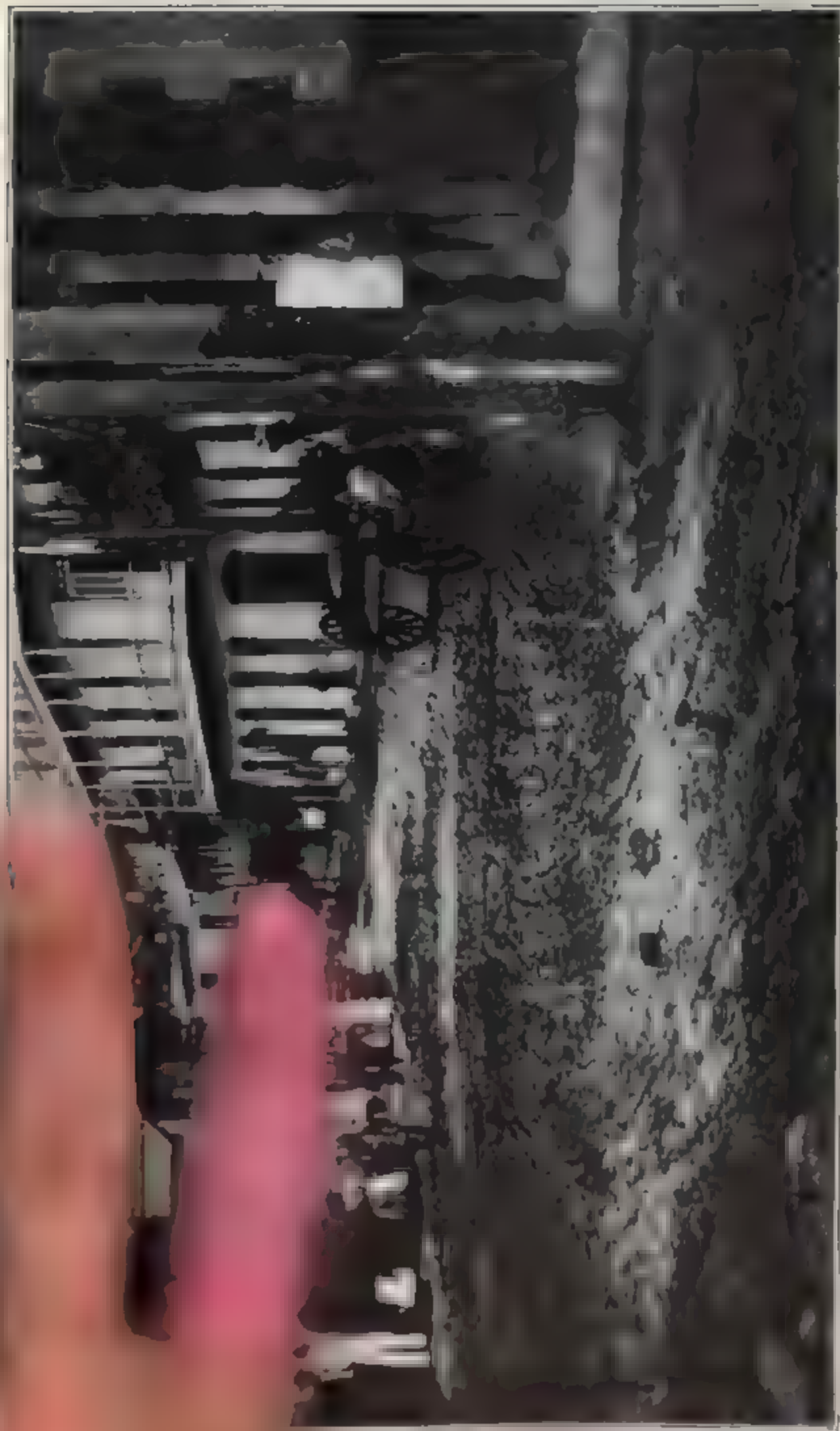
TWELFTH STREET PANAMA AFTER RAINING AUGUST 1907





NORTH AVENUE PANAMA, BEFORE PAYING JUNE 1907





NORTH AVENUE PANAMA BEFORE PANAMA CANAL JUNE 1907





NORTH AVENUE PANAMA AFTER PAVING AUGUST 1917





FOURTH STREET COLON BEFORE PAVING OCTOBER 1906



PLATE 56.



FOURTH STREET COLON AFTER PAVING AUGUST 1907





SECOND STREET COLON BEFORE PAYING OCTOBER 1907





SECOND STREET COLON AFTER FAYNG AUGUST, 1907





EIGHTH AND FRONT STREETS COLON BEFORE PAVING SEPTEMBER 1906





EIGHTH AND FRONT STREETS COLON AFTER PAYING OCTOBER 1906





ON THE ROAD BETWEEN LA BOCA AND PANAMA





TENTH AND BOLIVAR STREETS, COLON BEFORE PAVING, OCTOBER 1906





TENTH AND BOLIVAR STREETS, COLON AFTER PAVING AUGUST 1907





BOTTLE ALLEY COLON BEFORE PAYING SEPTEMBER 906





BARRACKS, CAMP ALFRED, ALASKA, JUNE 2



PLATE 66.



CASH ALLEY COLON, BEFORE PAVING SEPTEMBER 1906





CASH ALLEY, COLON AFTER PAVING AUGUST 1907



PLATE 68.



TENTH STREET FROM D STREET CO. LN BEFORE PAVING SEPTEMBER 1906





TENTH STREET FROM D STREET COLON AFTER PAVING AUGUST 1907

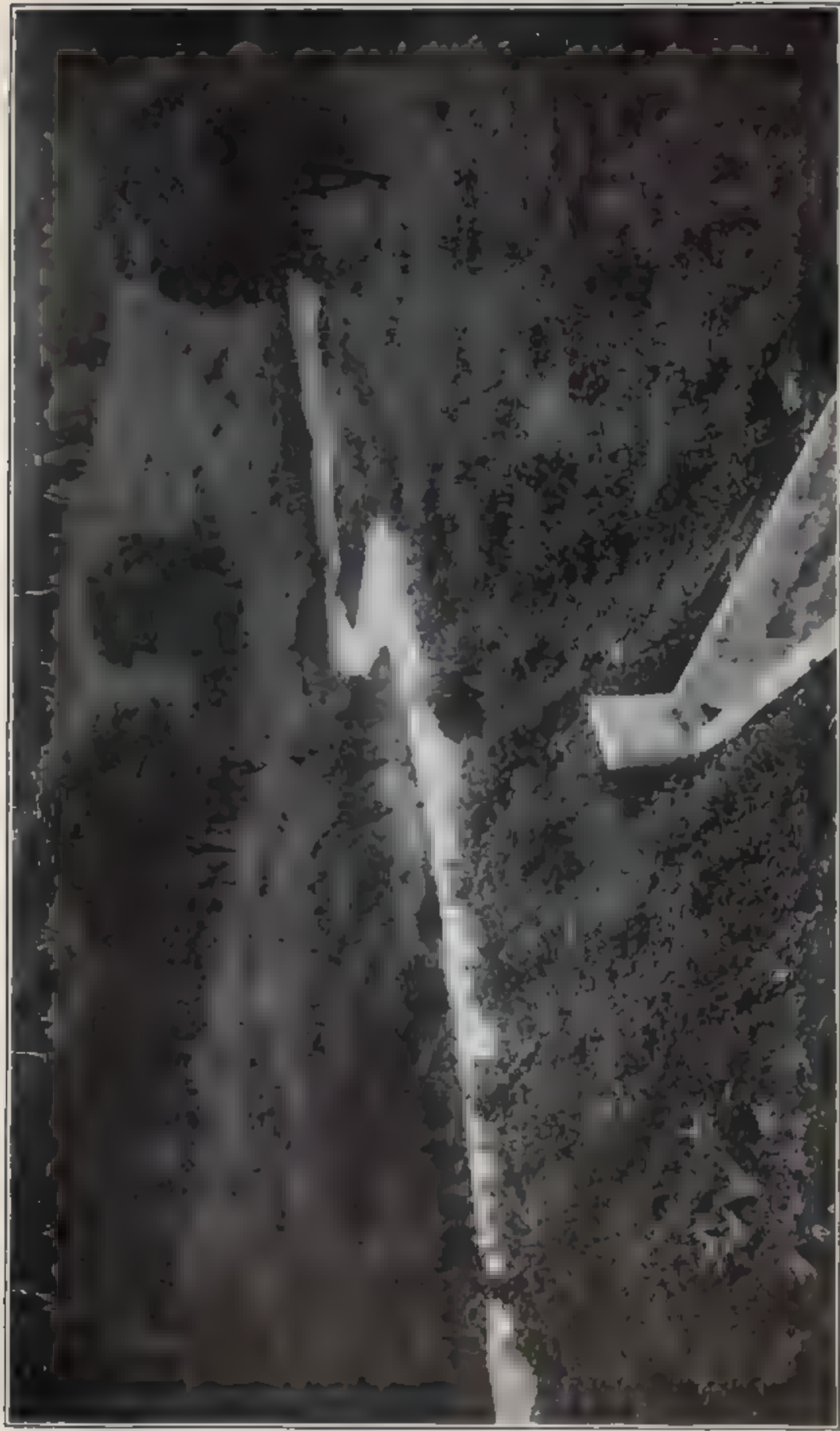


PLATE 70.



ROAD MAKING AT ANCON BEFORE COMPLETION





ROAD MAKING AT ANCON, AFTER COMPLETION





MACADAM ROAD, HOSPITAL GROUNDS, ANCON



PLATE 73.



CRISTOBA. BEFORE PAYING JANUARY 907



PLATE 74.



CRISTOBAL, AFTER PAVING AUGUST 907





FIRE DRILL, FRONT STREET, COLON.



ANCON SEWERAGE SYSTEM.

During the year the sewers have been extended as required to Tivoli Hill, Gobler's Knob; also to labor camps in the vicinity of Ancon. The following table shows details:

	Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total, July 1, 1907.
Vitrified pipe:			
4-inch.....linear feet ..	1,031	104	1,135
6-inch.....do.....	6,025	5,540	11,565
8-inch.....do.....	1,331	4,612	5,943
12-inch.....do.....		39	39
	8,387	10,295	18,682
House connections.....	40	52	92
Concrete manholes:			
4-foot diameter.....	29		29
3-foot diameter.....		33	33

LA BOCA.

The water and sewer system at La Boca was extended to meet growing demands during the fiscal year, as follows:

	Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total, July 1, 1907.
Cast-iron pipe:			
3-inch.....linear feet ..	1,442	50	1,492
6-inch.....do.....	12,543	555	13,098
	13,985	605	14,590
Wrought-iron pipe:			
1-inch.....do.....		260	260
1½-inch.....do.....		380	380
2½-inch.....do.....		493	493
3-inch.....do.....	354	584	938
4-inch.....do.....	267	401	668
6-inch.....do.....		1,116	1,116
	621	3,234	3,855
House connections.....	36	6	42
Hydrants.....	10		10
Hose valves.....	9	45	54
SEWERS.			
Vitrified pipe:			
4-inch.....linear feet ..	1,387	165	1,552
6-inch.....do.....	1,372	15	1,387
8-inch.....do.....	704		704
	3,463	180	3,643
House connections.....	37	2	39
Concrete manholes, 3½-foot.....	9		9

COROZAL.

The water system at this point was extended during the fiscal year to meet the growing conditions of this camp.

A sewer system was installed in the labor camp at East Corozal, carrying the sewage into the adjoining swamp.

The following table shows in detail the conditions as of the close of the fiscal year:

		Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total, July 1, 1907.
Cast-iron pipe.				
2-inch.....	linear feet..	540		540
4-inch.....	do.....	1,500		1,500
6-inch.....	do.....	945		945
		2,985		2,985
Wrought-iron pipe:				
1½-inch.....	do.....		758	758
2-inch.....	do.....		72	72
2½-inch.....	do.....	145		145
3-inch.....	do.....	150	10	160
3½-inch.....	do.....		800	800
		295	1,640	1,935
House connections.....		19	10	29
Hydrants.....		3		3
Hose valves.....		20	3	23
SEWERS.				
Vitrified pipe:				
4-inch.....	linear feet..	791		791
6-inch.....	do.....	1,570	1,712	3,282
8-inch.....	do.....	1,648		1,648
		4,018	1,712	5,730
Cast-iron pipe:				
6-inch.....	do.....	24	32	56
8-inch.....	do.....	24		24
		48	32	80
16-inch.....	do.....	13	0	13
Brick.....	do.....	15		15
Culvert.....	do.....	2		2
Manhole.....	do.....		8	8

MIRAFLORES.

At Miraflores the only work done consisted of minor repairs to the old French water and sewerage system.

PEDRO MIGUEL.

At the commencement of the fiscal year waterworks and sewer system were complete. The former consisted of old French 3-inch cast-iron pipe which had been taken up and relaid. Owing to town extension, a 4-inch line was laid and a new system installed. Details of the work done are as follows:

	Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total, July 1, 1907.
Cast-iron pipe:			
2½-inch.....linear feet..	60	32	92
3-inch.....do.....	1,464		1,464
4-inch.....do.....		1,637	1,637
6-inch.....do.....	180	166	346
	1,704	1,835	3,539
Wrought-iron pipe:			
1½-inch.....do.....		1,067	1,067
2-inch.....do.....		216	216
		1,283	1,283
House connections.....	21	35	56
Hydrants.....		1	1
Hose valves.....	6	8	14
SEWERS.			
Vitrified pipe:			
4-inch.....linear feet..	945	20	965
6-inch.....do.....	2,198	3,398	5,596
8-inch.....do.....	1,732	1,252	2,984
	4,875	4,670	9,545
Cast-iron pipe:			
6-inch.....do.....	24	56	80
8-inch.....do.....		92	92
	24	148	172
House connections.....	21	33	54
Concrete manholes:			
4 feet diameter.....	20		20
3½ feet diameter.....		15	15

About 500 feet of road near the old station has been graded.

PEDRO MIGUEL CRUSHER.

The crusher in operation at the commencement of the fiscal year was continued until November 26, 1906, when it was dismantled and shipped to Rio Grande Superior, where it was installed and is now operated. Previous to its removal and during the fiscal year it crushed 13,362 cubic yards.

PARAISO.

On account of the low pressure obtainable from the present gravity system in the upper part of the town, a 15,000-gallon tank was placed at elevation 240, to be supplied by a pump located in the machine shops and operated by the mechanical department. The following is a summary of the work done:

		Prior to July 1, 1906.	July 1 1906, to July 1, 1907.	Total, July 1, 1907.
Cast-iron pipe:				
4-inch.....	linear feet.	2,023	1,618	3,641
6-inch.....	do..	3,427	1,680	5,107
		5,450	3,298	8,748
Wrought-iron pipe.				
1½-inch.....	do.....		232	232
2-inch.....	do.....		408	408
2½-inch.....	do.....		957	957
3-inch.....	do.....		56	56
6-inch.....	do.....		235	235
			1,908	1,908
House connections.....		25	36	61
Hydrants.....			10	10
House valves.....			4	4
SEWERS.				
Vitrified pipe				
4-inch.....	linear feet	15	205	220
6-inch.....	do.....	192	4,775	4,967
8-inch.....	do.....	1,173	3,029	4,204
12-inch.....	do.....		390	390
		1,382	8,405	9,787
Galvanized-iron pipe, 8-inch.....	do.....		12	12
House connections.....		4	54	58
Concrete manholes, 3½ feet diameter.....		3	33	36

CUCARACHA.

This camp was formerly connected by 2-inch wrought-iron line across the canal. In order to furnish better supply, a 4-inch wrought-iron line has been extended from the Paraiso system. A sewer system has been authorized, but no pipe laid as yet. The following table shows the work accomplished during the year:

		Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total July 1, 1907.
Wrought-iron pipe				
1½-inch.....	linear feet		428	428
1½-inch.....	do.....		381	^a 381
4-inch.....	do.....		3,746	^a 3,746
2-inch.....	do.....	2,000	51	^a 2,051
		2,000	4,606	6,606
House connections.....			5	5

^a From Paraiso supply-pipe line.

RIO GRANDE RESERVOIR

For a general description of this reservoir, see previous annual reports. The drainage area of this reservoir amounts to 2,015 acres. The reservoir itself at the high-water line covered 59 acres. The elevation above mean tide of the spillway is 232.2 feet. The capacity of the reservoir between elevation 232.2 and the lowest reached during the year, 213.95, is 248,230,000 gallons. In January a 16-inch Venturi meter was installed to register all water passing from the Rio Grande reservoir. When it was installed, the water in the reservoir was at elevation 232.10. In the succeeding 149 days the water in the reservoir fell to 213.95. The consumption as indicated by the meter during this period was 299,519,000 gallons, or about 2,010,000 daily.

The capacity of the reservoir between these two elevations is 248,230,000 gallons. The inflow to the reservoir in excess of evaporation and leakage during the period of 149 days was therefore 51,361,000 gallons. This reservoir is connected with Panama and all points south of Rio Grande by a 16-inch main, which supplies all points between Rio Grande and the Pacific Ocean. In addition, by pumps located at Cucaracha, the towns of Rio Grande and Culebra and a part of the Culebra division are supplied with water from the Rio Grande source. There was also installed in the city of Panama a Venturi meter to measure all water passing into that city. This meter indicated a total consumption of 198,412,000 gallons for a period of 272 days, an average daily consumption by the city of Panama (and upon which revenue is collected) of approximately 729,000 gallons. The difference, 1,319,783 gallons per day, was used within the Zone for canal purposes. Two million forty-eight thousand seven hundred and eighty-three gallons is the estimated daily outflow from October 2, 1906, the date of the installation of the meter in Panama, to June 30, 1907. Rio Grande reservoir was highest December 4, 1906, when the water reached a point 3 feet 6 inches above the spillway. It was lowest on June 10, 1907. The new work carried on during the year at the reservoir, in addition to its maintenance and the installation of a Venturi meter, consisted of strengthening the dam by the completion of two masonry piers and completing the spillway. During the coming year it is intended to place flashboards in the spillway at the end of the rainy season, and thereby increase the storing capacity approximately 75,000,000 gallons.

A drainage ditch 3,260 feet long has also been built alongside the Panama Railroad to prevent the pollution of the reservoir.

On June 1, owing to the extremely prolonged dry season, it became necessary to install temporary pumps upon a float in the reservoir for the purpose of pumping water into the screen chamber at an elevation higher than could be had from the reservoir by gravity. This was necessary, not on account of the shortage of water, but because the pumps at Cucaracha have a suction lift limited to elevation 216. When the reservoir drops below this point these pumps would not operate. On June 19, the reservoir having risen, it was unnecessary to operate the pumps on float any longer.

RIO GRANDE STONE CRUSHER.

At the end of the year 1906 it became necessary to abandon the stone crushers erected by this division at Pedro Miguel on account of the site being required for active operations of the Culebra division, excavation department. After an examination of the ground at various points for good rock it was determined to place the crusher plant at Rio Grande. This was started in the early part of July, 1906. The first installation consisted of two French jaw crushers that had been used at Pedro Miguel. Later on the demand for stone became so much greater that a No. 5 crusher was installed. The demand speedily increased until it became necessary to install a second crusher, No. 5; thus, this plant at the present time consists of four crushers. The total output during the year was 49,512 cubic yards. At the present time the output averages 10,000 cubic yards per month. At the beginning this quarry required a considerable amount of work for stripping, but as it was one of the few points on the Isthmus, and especially because it was located at the summit of grade of Panama Railroad, and

CAMACHO RESERVOIR.

This reservoir has been built for the purpose of supplying Empire, Culebra, and Las Cascadas with water. It is built upon the Camacho Creek at a point about a mile south of Empire. The dam has a crest elevation of 365 feet above tide level. The reservoir area is 38 acres and the drainage area 592 acres. The capacity available for consumption is 258,000,000 gallons. The dam consists of a reenforced concrete core wall extending from hill to hill, heavily backed on both sides with clay fill. The wasteweir for dam is carried through the hills to the right or east of the dam. This wasteweir is 60 feet in width. The total height of the dam is 70 feet. The construction of the dam was started during the fiscal year ending June 30, 1906. The system of mains leading from the dam to Culebra, Empire, and Las Cascadas has been completed, and at the end of the present rainy season this dam will be in full operation thereby eliminating, to a large extent, the pumping now required at Cucaracha, Empire, and Las Cascadas. The following table shows the material used in the dam:

Kind of work.		Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total, July 1, 1907.
Earth fill.....	cubic yards	34,000	22,000	56,000
Concrete core wall	do	612	1,102	1,712
Waste way	do	358		358
11 spillway	do		887	887
11 screen of timber	do	109	310	419
Earth excavation, spillway	do		9,595	9,595
16-inch cast iron pipe	linear feet	363		363
Riprapping face	square feet		28,000	28,000

CAMACHO DISTRIBUTION SYSTEM.

Kind of work		Prior to July 1, 1906	July 1, 1906 to July 1, 1907.	Total, July 1, 1907.
Cast-iron pipe				
4-inch	linear feet	910	516	1,426
6-inch	do	330	372	702
8-inch	do	3,130	990	4,090
10-inch	do	3,420	2,244	5,664
12-inch	do	8,430	4,034	12,464
16-inch	do	2,770	2,004	4,774
Galvanized-iron pipe, 20-inch	do	18,700	10,130	28,830
		970	1,635	2,005

NOTE. Of the above, 970 feet 20-inch galvanized iron pipe and 2,820 feet 12-inch cast iron pipe was relaid, 1,320 feet 8-inch cast iron pipe was laid at Las Olispo, 1,025 feet of the 20-inch galvanized-iron pipe was laid in concrete and it, together with the 16-inch cast iron pipe, was supported on concrete piers where necessary to keep the grades. This work required 271 cubic yards of concrete.

The following table shows work completed at Empire and Camacho during the year:

Kind of work.		Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total, July 1, 1907.
Cast-iron pipe:				
2-inch	linear feet	800		800
3-inch	do.	200		300
4-inch	do.	1,100	1,208	2,308
6-inch	do.		4,738	4,738
		2,100	5,946	8,046
Galvanized-iron pipe				
2-inch	do.		800	800
3-inch	do.		878	878
4-inch	do.		1,985	1,985
			3,663	3,663
Standpipes			2	2
Fire hydrants			10	10
House connections		64	71	135
SEWERS.				
Empire.				
Sewer pipe				
4-inch	linear feet	2,048		2,048
6-inch	do.	3,030	5,461	8,491
8-inch	do.	2,740	5,042	7,782
		7,818	10,503	18,321
Steel spiral 8-inch	do.		60	60
Vitrified pipe, 12-inch	do.		137	137
Camacho				
Sewer pipe				
6-inch	do.		2,637	2,637
8-inch	do.		5,754	5,754
Spiral pipe, 8-inch	do.		134	134
			8,525	8,525
ROADS.				
Empire Macadam road	linear feet		1,356	1,356
Construct of Macadam road	do.	2,620	2,580	5,200

LAS CASCADAS.

At the beginning of the year the temporary system installed by the Panama Railroad was abandoned as insufficient for the growing population and a new system was authorized and laid out. A temporary supply is obtained from three pumps located north of the canal cut on the Bas Obispo River and three vertical boilers from old French stock. A double main runs across the canal. In addition to the pipe mentioned in tables appended hereto there is a complete system of 10-inch mains, connected to various water tanks erected by the Culebra division but which are supplied with water from the pumping system installed by this division.

The sterilizer was replaced in May by a standard condensing plant, supplied by the steam from air-compressor plant.

BAS OBISPO.

The water and sewer system is practically as it was last year. Additional connections have been made as buildings were erected. The pumping station reconstructed during the year now consists of two duplex pumps, 8½ by 10 by 12. In road building figures are given hereinafter, and Camp Elliott is included in Bas Obispo.



GENERAL VIEW OF GORGONA SHOPS





TRANSFER TABLE AND P.T., GORGONA SHOPS.





OFFICE BUILDING, GORGONA SHOPS.





YARDS AT GORGONA SHOPS



CHAGRESITO.

A 3-inch line was connected to this camp with Bas Obispo supply during the year. The sewer connects with baths, water-closets, kitchens, and hospitals, and the outfall is in the Chagres River.

SANTA CRUZ.

Water was supplied to this camp in March, 1907. A 2½-inch line was laid across the Chagres to the main at Matachin from the Gorgona system which ended near the old railroad station. A sewer line has been located and approved, but the pipe has not yet been received.

GORGONA MACHINE SHOPS.

A complete inside fire system has been authorized and installed in the car shops, planing mill, erecting shed, storehouse, and machine shop. A complete system of sewers for the shops has been built.

GORGONA.

Owing to increased demand on water supply, the storage capacity of the Carabali dam has been increased from forty millions to eighty-five millions by raising the dam 10 feet.

A condensing plant has been in operation for the past eight months in connection with the pumping station.

A sewer line to the new town is now under construction.

CABALLA VIEJO.

Water is supplied to this camp from Gorgona, and sewers have been installed discharging into the Chagres.

JUAN GRANDE.

Water is supplied to this camp from Gorgona.

MAMEI.

Water is supplied from Gorgona system. Work on sewers has not yet been started.

SAN PABLO.

A rain-water tank has been erected for use of engineering department.

TABERNILLA.

A complete new system of water has been installed with the exception of the pumping station and the lines from the pumps to the tank. A fire protection system has also been installed. A 2½-inch line runs to Camp La Voi, about a mile north of town.

The sewer system has been completed with the exception of a short line to the new camp on the west side of the railroad track.

GATUN.

A 6-inch cast-iron pipe line has been laid from the new town site to the site of the proposed pumping station on Gatuncillo River. A 5-inch galvanized-iron main has been laid through the entire town connecting all white quarters. A fire protection system has been installed. A permanent distilling plant was erected near the 50,000-gallon tank. A complete sewer system has been laid out and authorized. Foundations were laid for the erection of a 400,000-gallon tank.

BAS OBISPO CRUSHER.

During the operation of this crusher by this division from October 1, 1906, to January 15, 1907, the output was increased from 105 cubic yards per day to over 800 cubic yards. On the latter date the crusher was turned over to the Culebra division.

Character of material	Size.	Town.	Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total, July 1, 1907.
			<i>Linear ft.</i>	<i>Linear ft.</i>	<i>Linear ft.</i>
Water pipe..	2-inch.	Las Cascadas and White House.	.....	8,850	3,850
Do.	3-inch.	do.	.....	430	430
Do.	4-inch.	do.	.....	1,360	1,360
Do.	6-inch.	do.	.....	2,025	2,025
				7,665	7,665
Do.	2-inch.	Bas Obispo, etc.	2,300		2,300
Do.	6-inch.	do.	770		770
			3,070		3,070
Do.	4, 6, and 8 inch.	Gorgona.	17,770		17,770
Do.	2½-inch.	do.		1,190	1,190
Do.	1-inch.	do.		2,100	2,100
Do.	3-inch.	do.		1,400	1,400
Do.	4-inch.	do.		8,240	8,240
Do.	6-inch.	do.		1,465	1,465
Do.	8-inch.	do.		750	750
			17,770	15,145	32,915
Do.	1-inch.	Tabernilla.		600	600
Do.	2-inch.	do.		1,680	1,680
Do.	3-inch.	do.		6,383	6,383
Do.	5-inch.	do.		1,325	1,325
				9,988	9,988
Do.	1-inch.	Gatun.		2,000	2,000
Do.	1½-inch.	do.		500	500
Do.	2½-inch.	do.		2,000	2,000
Do.	5-inch.	do.		3,575	3,575
Do.	6-inch.	do.		5,750	5,750
				13,825	13,825
Do.	2½-inch.	Matachin.		4,400	4,400
Sewer pipe	6 inch.	Las Cascadas and White House		6,005	6,005
Do.	8 inch.	do.		550	550
				6,555	6,555
Do.	6 inch.	Bas Obispo	1,165		1,165
Do.	Different sizes.	Haut Obispo	3,850		3,850
Do.	6 inch.	Matachin.		1,275	1,275
Do.	8 inch.	do.		850	850
				2,125	2,125
Do.	All sizes.	Gorgona	3,675		3,675
Do.	6 inch.	do.		4,230	4,230
Do.	1 inch.	do.		150	150
			3,675	4,380	8,055
Do.	6 inch.	Tabernilla		4,297	4,297
Do.	8 inch.	do.		1,358	1,358
				5,655	5,655
Do.	6 inch.	Gatun		8,203	8,203
Do.	8 inch.	do.		3,533	3,533
				11,736	11,736

Character of material.	Size.	Town.	Prior to July 1, 1906.	July 1, 1906, to July 1, 1907.	Total July 1, 1907.
			<i>Number.</i>	<i>Number.</i>	<i>Number.</i>
House connections.....		Las Cascadas.....	10	160	170
Do.....		Buena Vista.....	3	45	48
Do.....		Bas Obispo.....	64	20	84
Do.....		Camp Elliott.....	36		36
Do.....		Gamboa.....	10	22	32
Do.....		Chagresito.....	11	19	30
Do.....		Haut Obispo.....		25	25
Do.....		Santa Cruz.....		102	102
Do.....		Matachin.....		36	36
Do.....		Gorgona.....	92	106	198
Do.....		Jamaicatown.....	17	49	66
Do.....		Cabulla Viejo.....	12	12	24
Do.....		Juan Grande.....		11	11
Do.....		Tabernilla.....	14	90	104
Do.....		Gatun.....		137	137
			269	834	1,103
Hose connections.....		Las Cascadas.....		40	40
Do.....		Santa Cruz.....		6	6
Do.....		Gorgona.....		13	13
Do.....		Tabernilla.....		23	23
Do.....		Gatun.....		27	27
Water faucets.....		Las Cascadas.....		24	24
Do.....		Bas Obispo.....		2	2
Do.....		Chagresito.....		9	9
Do.....		Matachin.....		2	2
Do.....		Santa Cruz.....		12	12
Do.....		Tabernilla.....		17	17
Fire hydrants.....		Matachin.....		2	2
Do.....		Gorgona.....		22	22
Tanks.....	50M.....	Las Cascadas.....		1	1
Do.....	8 by 14.....	do.....	1	1	2
Do.....	8 by 15.....	do.....		1	1
Do.....	8 by 8.....	do.....		2	2
			1	5	6
Do.....	8 by 8.....	Bas Obispo.....	11		11
Do.....	50M.....	do.....	1		1
			12		12
Do.....	50M.....	Matachin.....		1	1
Do.....	8 by 8.....	Gorgona.....		2	2
Do.....	8 by 13.....	Tabernilla.....	1		1
Do.....	8 by 16.....	do.....	1		1
			2		2
Do.....	8 by 8.....	Gatun.....		4	4
Do.....	50M.....	do.....		1	1
				5	5
Water column.....		Las Cascadas.....		1	1
Do.....		Bas Obispo.....		1	1
Do.....		Gorgona.....		4	4
Standpipes.....		Gatun.....		2	2

ROADS.

During the fiscal year 3,130 linear feet of road have been built in Las Cascadas and White House district, 3,886 in Bas Obispo, 7,600 in Gorgona, and 9,200 in Gatun district.

BRAZOS BROOK WATER SUPPLY.

This supply furnished Cristobal and Colon. From January 25 to May 25, 1907, Mindi diversion also furnished water. The reservoir was completed in December, 1906. The following table shows the amount of material handled:

	Prior to July 1, 1906	July 1, 1906, to July 1, 1907	Total July 1, 1907.
	Cubic yards.	Cubic yards.	Cubic yards.
Dam No. 1.....	42,200	19,728	61,928
Dam No. 2.....	29,300	13,459	42,759
Dike No. 3.....	13,500	8,483	21,983
Total.....	76,000	41,667	117,667

The area of the reservoir as completed is 122 acres. The area of the watershed is 638 acres. High-water elevation is 45.1. At this elevation the capacity of the reservoir is 435,000,000 gallons. On July 30, 1907, the elevation was 38.2, with a capacity of 115,691,000 gallons.

The rainfall at Brazos during the year was:

1906.	Inches.	1907.	Inches
July	20.82	January.....	2.06
August.....	16.25	February.....	.91
September	14.61	March.....	1.97
October	16.40	April.....	1.07
November.....	23.66	May.....	6.82
December.....	16.17	June.....	14.81
	107.91		27.64

Total rainfall, 135.55 inches.

On February 23, 1907, 800 pounds of copper sulphate were distributed in the reservoir in order to kill the vegetable growth. In three days the growth had disappeared.

MOUNT HOPE PUMPING STATION.

During the year two pumps and two 80-horsepower boilers were installed.

MOUNT HOPE FILTRATION PLANT.

Filtration plant similar to that installed at Ancón and described in section devoted to that place in this report was installed at Mount Hope and will be in operation during July.

MOUNT HOPE CEMETERY.

Two miles of gravel road, 3½ miles of gravel path, and two concrete bridges have been built in the improvement of this place.

METER SERVICE.

The following meters were installed in connection with the Brazos Brook water supply: No. 1, 20-inch Venturi, Mount Hope, registering amount of outflow; No. 2, 2-inch Crown meter, at Union Oil Company; No. 3, 10-inch Venturi, commissary, registering water used in Cristobal; No. 4, 10-inch Venturi, registering Panama Railroad consumption; No. 5, system of Crown meters at Colon Hospital; No. 6, 127 meters, ½-inch (Crown), for private connection; No. 7, 8-inch Venturi, at dry dock.

CRISTOBAL WATER SERVICE.

Connections were made to dock 11, ice plant, bakery, and laundry. Four-inch connections were made to supply clapnets with water. Forty-two house connections were put in and 26 fire hydrants installed.

CRISTOBAL AUXILIARY WATER SUPPLY.

The old 4-inch line of the Panama Railroad was torn up and 6-inch main laid from Mindi pumping station to the dry dock and to the Cristobal machine shops. This 6-inch main is 8,500 feet in length.

CRISTOBAL SEWERAGE SYSTEM.

Sewers were constructed in Camp Bierd and to the machine shops and Cristobal market, requiring the following material:

	Linear feet.		Linear feet.
6-inch vitrified pipe.....	2,477	15-inch vitrified pipe.....	1,348
8-inch vitrified pipe.....	459	20-inch vitrified pipe.....	327
10-inch vitrified pipe.....	311	10-inch cast-iron pipe.....	207

CRISTOBAL ROADS.

The amount of road work completed to date in Cristobal has required:

Grading.....	cubic yards..	6,952
Earth fill.....	do.....	3,200
Macadam spread.....	square yards..	23,463
Concrete curb and gutter.....	linear feet..	20,187
Open drains.....	do.....	900
Catch basins.....		12

MOUNT HOPE ROAD.

This road connects Cristobal with Mount Hope. To date 80 per cent of the work has been completed.

FIRE PROTECTION.

At the time of the last annual report 87 fire plugs were in use. Since that time 27 have been installed, and the following table shows how they all are distributed:

Colon.....	42
Beach road.....	13
Colon Hospital.....	10
Wireless and quarantine.....	6
Canal Zone:	
Dry dock.....	9
Mount Hope.....	8
Cristobal.....	26
Total.....	114

An auxiliary fire-protection system has been laid as follows.

Mount Hope storehouse.—A 6-inch lateral was laid from the 20-inch main and twenty-four 2½-inch hose connections made.

Dry dock.—Two 2½-inch connections, made from 6-inch lateral.

Dock 14.—Six-inch lateral supplies, fifteen 2½-inch connections.

Dock 11.—Fourteen 2½-inch connections were installed. In vicinity of ice plant a fire cistern or sump was constructed well below sea level and connected with the bay by a 16-inch pipe for use in case of emergency.

Commissary.—Twelve 2½-inch connections were installed.

Medical store, Colon Hospital.—Twelve 2½-inch hose connections.

Fire pier.—This pier extends about 25 feet over the water at the northern end of Roosevelt avenue, Cristobal, and a 6-inch suction pipe with 4-inch reducer is attached. Fire engine can be run out on this pier in case of emergency.

WATER SERVICE INSPECTION

An inspector locates and reports leaks and inspects all plants and buildings connected with the water supply at least twice a week.

LABOR CONDITIONS.

The labor supply has been ample to meet the demands at all times. The superiority of the European laborer over the West Indian laborer has been very apparent. There is given herewith a statement showing the average number of employees during the present fiscal year.

	Daily average.	
	Silver.	Gold and silver.
1906.		
July.....	1,458	2,284
August.....	2,206	2,371
September.....	2,205	2,359
October.....	2,000	2,150
November.....	2,054	2,210
December.....	2,323	2,473
1907		
January.....	2,682	2,815
February.....	3,090	2,204
March.....	3,971	2,859
April.....	2,889	3,067
May.....	2,607	2,667
June.....	2,168	2,320
Average day for year.....	2,380	2,503

BACTERIOLOGICAL EXAMINATION OF RESERVOIRS.

Through the courtesy of the Department of Agriculture, Dr. Karl F. Kellerman, physiologist in charge of the Bureau of Plant Industry, visited the Rio Grande and Mount Hope reservoirs in February, 1907, treated them with copper sulphate, and made an exhaustive report on them. This report states that the water supplies on the Zone, as examined by him in February, 1907, were in very excellent condition from a bacteriological standpoint. An assistant from the Department of Agriculture has been engaged to remain on the Isthmus for a year, in making a study of the treatment of water supply. He will take up his duties during the month of September.

Statement of expenditures for the fiscal year ending June 30, 1907, for the division of municipal engineering.

Work.	Material.	Labor cost.	Supervision, etc.	Total.
Panama waterworks and sewers.	\$47,834.21	\$39,618.88	\$14,003.20	\$101,454.29
Ancon and Lirio water supply and sewers.	30,904.05	21,184.46	11,154.80	63,243.31
La Boca water supply and sewers.	1,842.08	1,461.90	786.67	4,090.65
Taboga water supply and sewers.	1,126.15	954.10	717.33	2,797.58
Corozal, Pedro Miguel, and Paraiso water supply and sewers.	16,479.48	13,337.14	6,511.88	36,310.50
Culebra water supply and sewers.	17,133.68	20,666.23	10,967.54	48,767.45
Empire and Comacho waterworks and sewers.	48,096.48	91,577.23	33,946.87	173,610.58
Las Cuscas water supply and sewers.	18,077.20	18,228.22	4,864.92	41,170.34
Bas Obispo water supply and sewers.	8,377.47	11,474.48	3,070.87	22,922.82
Gorgona water supply and sewers.	26,045.01	27,300.15	10,714.21	64,059.37
Tabernilla water supply and sewers.	10,060.06	16,852.86	2,935.48	29,848.40
Gatun water supply and sewers.	54,741.24	31,041.31	8,533.36	94,315.91
Cristobal water supply and sewers.	13,227.54	13,434.52	4,843.27	31,505.33
Colon waterworks and sewers.	65,115.48	89,069.88	39,461.42	194,646.78
Supply plant, Panama waterworks.		581.18	40.00	621.18
Rio Grande reservoir.		1,906.52	846.04	2,752.56
Rio Grande crusher.	32,487.64	97,606.73	13,004.36	143,098.73
Pedro Miguel crusher.	1,292.42	14,024.14	1,809.14	17,125.70
Bas Obispo crusher.	3,230.11	18,346.58	3,668.63	25,245.32
Ancon, Lirio, La Boca, Santa Rosa, etc., roads.	4,544.83	48,066.11	13,498.39	66,109.33
Culebra and Comacho roads.	4,417.29	15,746.37	3,297.80	23,461.46
Las Cuscas roads.	105.81	1,427.60	315.28	1,848.69
Gatun roads.	4,287.02	9,177.11	2,519.12	15,983.25
Bas Obispo and Gorgona roads.	188.25	8,557.66	4,060.58	12,806.49
Cristobal and Mount Hope roads.	26,547.15	34,350.64	10,417.03	71,314.82
Culebra and Tabernilla roads.	1,467.20	11,830.55	1,989.25	15,286.00
Panama paving.	29,009.27	74,736.79	18,479.99	122,226.05
Colon paving.	197,290.92	62,146.19	17,235.33	276,672.44
Main office.	4,548.30		38,491.60	43,039.90
Total.	669,047.42	789,973.22	282,933.26	1,741,953.90

DIVISION OF MOTIVE POWER AND MACHINERY.

The mechanical division commenced the fiscal year with old shops at Cristobal, Gorgona, Empire, and Paraiso, engine houses at Lirio and Cucuracha, and air-compressor plants at Rio Grande and Empire.

During the year work was commenced on new shop plants at Empire and Paraiso, the old plants having been continued in service practically as left by the French, wholly inadequate to the demands and impossible of alteration to meet same.

The plant at Empire is especially designed for the maintenance and repair of steam shovels and steel dump cars, and that at Paraiso for light repairs only of practically all of the equipment at the south end of the cut. When completed they will be equipped with modern machinery, which is now being installed. The Empire plant is to be operated by electric motors.

Owing to the opening up of new centers of work and the desirability of being able to take care of the running repairs of rolling stock in close proximity to its work, limited facilities for handling equipment and making running repairs are being provided at Pedro Miguel, Rio Grande (to replace the old Cucuracha engine house), and Tabernilla, and in the near future similar facilities will have to be provided at Gatun and La Boca.

GORGONA SHOPS.

(Until December 24, 1906, these shops were known as Bas Matachin shops.)

Under the French régime they were, as now, the principal shops of the Isthmus. They consist at present of the following buildings:

Foundry, 120 by 70 feet, containing 3 cupolas, core ovens, and 6 brass furnaces, with all the necessary machinery and equipment for

making 800,000 pounds of gray iron castings and 70,000 pounds of brass castings per month when operating to their full capacity. Despite the fact of the higher rates of wages prevailing here and the distance from market, these castings are produced at a cost which compares very favorably with the market prices of same in the States—i. e., 4 cents per pound for iron and 18 cents per pound for brass, including all labor and material.

Adjacent to this building is a storehouse, 30 by 60 feet, for core material and molding sand; also a coke bin, 130 by 30 feet, under roof, and a pattern storage house, 30 by 75 feet, for the storage and preservation of patterns.

Planing mill, 60 by 120 feet, fully equipped with woodworking machinery and tools.

Boiler and tin shop, 90 by 288 feet.

Erecting shop, covering 22 locomotive pits, each division 70 by 22 feet. A transfer pit, 50 by 476 feet, with steam propelled transfer table 50 feet long. Between the erecting shop and the transfer pit is a platform, 50 feet wide, running the entire length of the erecting shop.

Machine shop, 90 by 180 feet; tool room, 32 by 32 feet; iron rack, 20 by 115 feet.

Car-repair shop, carpenter shop, and pattern shop. These three shops are practically one, being contained in a building 130 by 325 feet, in which are three tracks running the entire length of the building, with a capacity of 32 cars.

In this same shop is also installed one 160-horsepower engine and one 100-kilowatt generator—sufficient capacity to furnish all the lights needed at the shops and quarters and for street lighting at Gorgona and Matachin.

Blacksmith shop, 60 by 325 feet.

Power plant, 50 by 50 feet, containing a battery of six 200-horsepower boilers, from which steam pipes run to all of the other shop buildings where stationary engines are located.

Paint shop, 60 by 119½ feet, opening upon a platform 30 by 70 feet.

Office building, 50 by 50 feet.

Instrument repair shop, 30 by 40 feet, equipped for repairing levels, transits, current meters, fluviographs, clocks, watches, and other instruments of precision.

Lavatories and latrines: The shop is well equipped with lavatory and latrine facilities.

Shop yards: The layout of the shop yards has been entirely rearranged and the trackage greatly increased so that it is ample for the plant. All of the buildings of this plant are well equipped with the machinery necessary for the character of the work handled in each one of the different departments of the shop plant.

The division of material and supplies has two storehouses at this point, one 50 by 200 feet and the other 150 by 250 feet, with ample storage platforms.

ENTIRE SHOP.

This shop plant is not completed, but when finished early in 1908 will consist of the following:

Office building (completed), 30 by 55 feet.

Machine shop, 80 by 224 feet.

Boiler shop, 100 by 224 feet.

PLATE 80.



GORGONA PATTERN SHOP





GENERAL VIEW OF SHOPS AT PARAISO.



RA





INTERIOR OF PARAISO BOILER SHOPS.





MEALTIME AT AN I. C. C. KITCHEN AT UPPER RIO GRANDE.





MEALTIME AT AN I. C. C. KITCHEN AT LOWER RIO GRANDE.





MEALTIME AT AN I. C. C. KITCHEN AT LOWER RIO GRANDE.





INTERIOR OF GORGONA MACHINE SHOP.





INTERIOR OF GORGONA BLACKSMITHS' SHOP.



PLATE 89.



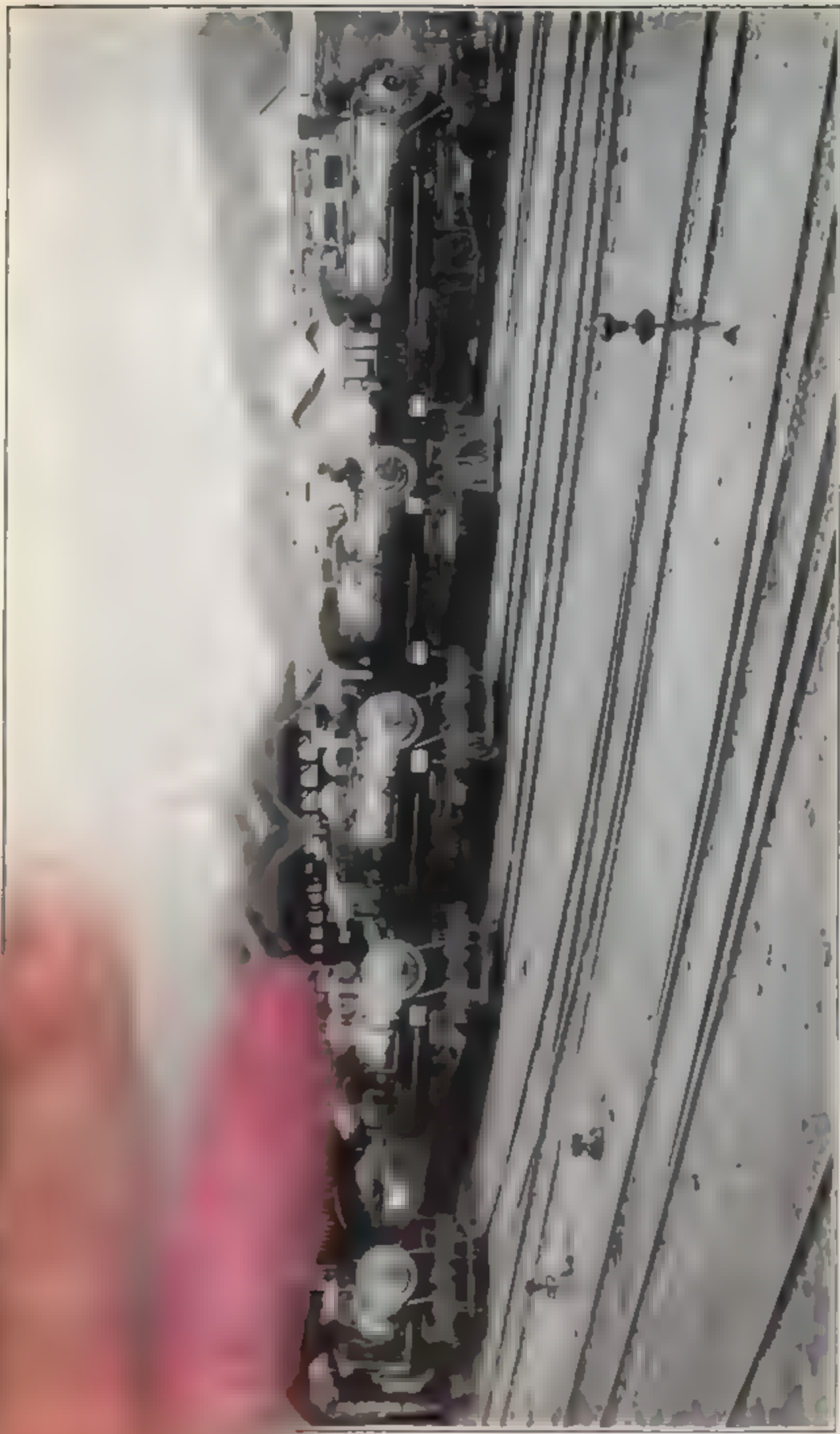
INTERIOR OF GORGONA WOOD-WORKERS' SHOP.





ENGINE HOUSE AT LAS CASCADAS.





ENGINE HOUSE AT LAS CASCADAS.



PLATE 91.



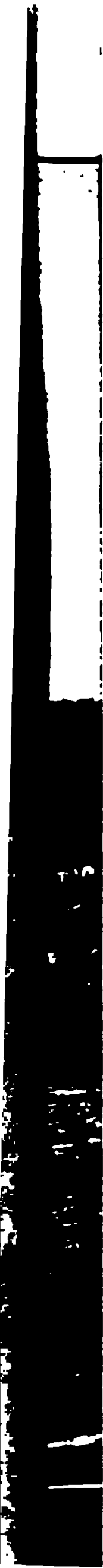
POWER PLANT AND COAL CHUTE AT LAS CASCADAS.





TION, J







I. C. C. CHAPEL AT ANCON





ADMINISTRATION BUILDING AT ANCON.





HOTEL TIVOLJ, ANCON.





HOTEL T. VOLI, ANCON



PLATE 98.



- C C HOTEL AT CRISTOBAL.



PLATE 99.



DINNER TIME AT A COMMISSION HOTEL, AT GORGONA.



TYPE NO. 14, FOUR-FAMILY HOUSE AT CULEBRA SCHOOL HOUSE IN THE DISTANCE





DINING ROOM IN FAMILY QUARTERS.





DINING ROOM IN FAMILY QUARTERS





SITTING ROOM N FAMILY QUARTERS.



Erecting shop, 14 pits, 80 by 362 feet, of ample size to afford clearance for the handling of general repairs of steam shovels.

Transfer pit, 60 by 362 feet, and a 60-foot transfer table, operated by steam.

Car shop, 100 by 405 feet, containing 5 tracks, with a capacity of 40 cars.

Planing mill, 70 by 225 feet.

Lavatories and latrines: The shop is well equipped with lavatory and latrine facilities.

Storehouse, 100 by 300 feet, with 3,700 square feet of platform space additional. This storehouse is under the jurisdiction of the division of material and supplies.

All of these shops to be equipped with the machinery necessary for the work they are designed to handle, which machinery will be operated by a system of electric motors.

Electric-light plant, 86 by 35 feet, containing two 100-kilowatt generators, direct connected to a 160-horsepower tandem compound engine, also a 200 kilowatt generator and engine, now being installed; furnishing, in addition to the power at the shops, current for lighting all quarters and streets at Empire and Culebra, with sufficient reserve capacity for the lighting needed at Las Cascadas roundhouse and Paraiso shops, as well as the various labor camps and settlements between these two points, which are 7 miles apart.

Power plant, 42 by 141 feet, containing a battery of twelve 200-horsepower boilers, to furnish steam for the operation of the air compressor plant (described under the head of these plants) and the electric-light plant.

The shop yards are designed for adequate storage and handling room.

CRISTOBAL SHOPS.

The entire plant at Cristobal was, on November 15, 1906, turned over to the Panama Railroad Company for operation, under lease. It consists of the following:

Machine shop, 91 by 116 feet.

Blacksmith shop, 43 by 118 feet.

Boiler shop, 70 by 116 feet.

Planing mill, 60 by 180 feet.

Power house, 30 by 30 feet, equipped with 4 boilers of 125 horsepower.

Car shop, 100 by 400 feet, through which runs 5 tracks with a capacity of 50 cars.

Office building, 40 by 66 feet.

Roundhouse, 20 stalls for handling locomotives.

Erecting shop, 75 by 200 feet, containing 9 pits.

Transfer pit, 50 by 200 feet, with a 50-foot transfer table, operated by steam.

Between the erecting shop and the transfer pit is a platform 50 feet wide, running the entire length.

Coal chute, on which cars loaded with coal are elevated by steam winch and cable, dumped into 20 pockets for delivery to locomotives. This building also contains appliances for drying and delivering sand to locomotives.

The plant is provided with the necessary cinder pits, storehouses, oil house, etc., and fully equipped with the necessary machinery and tools to handle the mechanical features of the Panama Railroad work. The shops also handle the repairs to marine equipment of the Panama Railroad and Steamship Company.

PARAISO SHOPS.

These shops consist of—

Machine shop, 60 by 160 feet.

Blacksmith and boiler shop, 85 by 160 feet.

Office building, 20 by 50 feet.

Erecting shop, 73 by 150 feet, containing 6 pits of such construction as to be suitable for both locomotive and steam-shovel repairs.

Latrine and lavatory, 30 by 60 feet.

Iron rack, 20 by 60 feet.

Carpenter shop, 32 by 60 feet.

There is also being erected for the division of material and supplies a storehouse 30 by 140 feet, with ample platform space.

LAS CASCADAS ENGINE HOUSE.

This consists of a rectangular building 90 by 300 feet, containing 5 tracks, with a total capacity of storing 40 engines, with the necessary cinder pits and a small repair shop and machinery to handle the running repairs of the locomotives cared for there.

LAS CASCADAS COAL CHUTE.

At Las Cascadas is located a coal chute, on which cars loaded with coal are elevated on an incline by means of a hoist operated by compressed air from the air pipe line, and dumped into 20 pockets for delivery to locomotives. This building also contains appliances for drying and delivering sand to locomotives.

LIRIO ENGINE HOUSE.

This is a small building, 121 by 26 feet, with a capacity of 10 engines. The building is new, as the old one (erected by the French) was torn down on account of being in the line of excavation. The plant is designed for taking care at night of the engines working on the side of the cut opposite Culebra.

RIO GRANDE ENGINE HOUSE.

A new engine house is being built, 54 by 180 feet, with a capacity of 9 locomotives.

PEDRO MIGUEL COAL CHUTE.

At Pedro Miguel is located a coal chute, on which cars loaded with coal are elevated on an incline by a hoist operated by compressed air from the air pipe line, and dumped into 20 pockets for delivery to locomotives. This building also contains appliances for drying and delivering sand to locomotives.

AIR-COMPRESSOR PLANTS.

For the purpose of furnishing compressed air to operate rock drills, stone crushers, etc., there have been constructed three plants, connected by 9½ miles of 10-inch pipe-line mains, extending from Bas Obispo to Pedro Miguel, with 6-inch and 4-inch leads running into the canal prism for the various purposes. These plants contained on June 30 an aggregate of 12 air compressors, each with a capacity of 2,500 cubic feet of air per minute, at 100 pounds pressure, all feeding into the one line. These plants also supply air for operating the coal chutes at Pedro Miguel and Las Cascadas, as well as the necessary use of compressed air at Empire and Paraiso shops.

The organization of the mechanical division on June 30, 1907, consisted of 2,479 men, divided into divisions as follows:

Office of superintendent motive power and machinery.....	55
Gorgona shops.....	1, 197
Empire shops.....	628
Paraiso shops.....	387
Air-compressor plants.....	91
Electrical subdivision.....	121
Total.....	2, 479

During the year 1,008 artisans and clerks for this division were sent down from the United States and 637 returned through various causes. The grade of artisans being received for this division has improved during the fiscal year in question. There are fewer unsatisfactory mechanics now being received than has been the case heretofore. During the year the operation of the division has been hampered by the lack of sufficient and properly skilled force.

The completion of the Empire shop plant will necessitate the addition of approximately 250 first-grade skilled mechanics and the necessary helpers for same to properly man the plant.

Statement of the principal items of equipment in service or available on the Isthmus, June 30, 1906, and June 30, 1907.

[All erected and made ready for service by the mechanical division.]

Equipment.	June 30, 1906.	June 30, 1907.
Steam shovels:		
45-ton.....	1	3
70-ton.....	15	28
95-ton.....	23	32
Locomotives:		
French.....	100	100
New American.....	30	184
Cars:		
French dump.....	541	250
American.....	324	455
American flat (wood).....	1,061	1,501
American flat (steel).....	500	500
Lidgerwood unloaders.....	12	18
Bank spreaders.....	13	13
Unloading plows.....	22	33
Track shifters.....	0	3
Pile drivers.....	1	7

Statement of some of the principal items of work done during the fiscal year.

Item.	Gorgona.	Empire.	Paraiso.	Cristo- bal.	Electrical sub- division.	Air com- pressor plant.
Locomotives repaired in shops . . .	20	24	13			
Locomotives, running repairs . . .	1 159	893	4 110	180		
Locomotives (new) erected . . .	89			13		
Cars erected . . .				109		
Cars repaired . . .	10,086	872	14,306	305		
Work equipment erected . . .	13	11		7		
Work equipment repaired . . .	803	284	500	30		
Steam shovels repaired in shops . . .		11	5			
Steam shovels, running repairs . . .		750	144	5		
Steam shovels erected . . .		22				
Locomotives cared for nights . . .	1,644	17,155	12,755			
Air compressors installed . . .						8
Dynamos installed . . .					3	
Buildings wired . . .					230	
Lights installed . . .					3,578	
Manufactured iron castings . . .	3,990,703					
Manufactured brass castings . . .	207,425					
Manufactured pattern castings . . .	1,780					

Statement of expenditures for the year.

	Labor	Material	Total.
Maintenance and repairs	\$890,275.31	\$350,808.16	\$1,245,134.47
New equipment	264,704.75	4,087,180.05	4,351,884.80
Other departments	625,208.64	237,208.65	763,477.29
Total	1,776,200.70	4,684,296.86	6,360,498.56

The shops of the division have carried on the design, construction, and operation, as desired, to supply the numerous and varied wants of the different departments, covering an unusually wide range of service and experiment. Notwithstanding this has been the principal feature of the work of the division, detailed list of same is omitted because of its length.

A thorough boiler-inspection service has been established, covering all the boilers on the Isthmus, including the Panama Railroad.

The jurisdiction of the mechanical engineer, master car builder, and electrical engineer has been extended to the Panama Railroad.

The use of oil for fuel in all stationary plants, pumping stations, heating and welding furnaces, and various uses other than in locomotives, is under consideration and the necessary plans are being made.

The capacity of this division is not adequate to the extensive and rapidly increasing demands, but with the completion of the Empire shop plant, the addition of ample and proper amount of skilled force to operate it to its capacity, the completion of the engine houses at Rio Grande, Pedro Miguel, La Boca, and Gatun, and electric-lighting facilities ample to care for all of such needs at Gatun the division will be able to meet the requirements for next year, as now foreseen, providing appropriation is made sufficient to cover the necessary expenditures.

ELECTRICAL SUBDIVISION.

The principal work of the electrical department during the year just closed has been the construction of electric-lighting plants at Empire and Gorgona.

The Culebra-Empire lighting plant was placed in operation January 12, 1907. It contains the following equipment: One G. E. Co. 15-kilowatt 125-volt marine set; one 10-panel switchboard; two 100-kilowatt 2,300-volt, 3-phase alternating current generators, direct connected to 160-horsepower tandem compound Ball engines.

The plant has a capacity of approximately 4,000 candlepower lights. About ten miles of pole line have been constructed in connection with the plant. This plant now supplies light to practically all buildings at Culebra, Empire, Rio Grande, Enterprise, Cerro, and Lirio, and extensions to Las Cascadas at one end of the line and to Paraiso at the other end are now under way. The following table shows the number of buildings wired for lights in the towns mentioned above and the total number of lights at present operating:

	Buildings.	Lights.
Culebra.....	150	2,393
Empire.....	70	1,030
Enterprise, Rio Grande, Cerro, Lirio.....	30	143
	250	3,566

The Gorgona-Matachin lighting plant has been in operation since May 2, 1907. This plant contains the following equipment: One Westinghouse 125-250-volt, 100-kilowatt, direct current generator, direct connected to a 160-horsepower tandem compound Ball engine, and one 4-panel switchboard, and has a capacity of approximately 2,000 16-candlepower lights. Three miles of pole lines are connected with this plant, and light is furnished to all buildings at Gorgona and Matachin, including Gorgona shops.

Fixtures were installed in official houses at Gorgona, Empire, and Culebra.

These two plants have been operated regularly, the pole lines have been maintained in good order, and all necessary repairs and alterations in house wiring have been made.

A considerable amount of miscellaneous work has been accomplished by the electrical department during the year, as shown below:

An automatic fire-alarm telegraph system, with 10 stations, was purchased and installed at Colon, Cristobal, and Mount Hope.

An electrical blue-printing apparatus was installed in the administration building at Culebra and is now being operated.

The department has made all necessary repairs to blasting batteries for the excavation department.

An arc-light circuit, consisting of 13 lamps, has been installed and is now in operation at Empire.

Gorgona has also been provided with an arc-light circuit.

Various Commission buildings at Cristobal and at Ancon have been wired for lights to be furnished by the Panama Railroad Company's plants. This work included the wiring of Tivoli Hotel for 500 lights and a part of the installation of the hotel telephone system.

Other miscellaneous work of less importance has also been done.

Work at present under way and for which specifications have been drawn and other preliminary work done is mentioned below:

An additional unit, consisting of one 200-kilowatt, 2,300-volt, 3-phase, alternating current generator, direct connected to a tandem compound, 4-valve Harrisburgh engine, is to be placed in the Culebra-Empire electric-lighting plant.

An additional unit, consisting of one 100-kilowatt, 125-250 volt, 3-wire Westinghouse generator, direct connected to a tandem compound engine, is to be placed in the Gorgona-Matachin electric-lighting plant.

The pole line for the Culebra-Empire plant is to be extended to Las Cascadas and Paraiso, and these towns are to be wired for lights.

An arc-lamp circuit of 16 lamps is to be installed at Culebra.

An arc-lamp circuit of 17 lamps is to be installed at Cristobal.

All Commission hotels are to be equipped with electric fans.

The town of Gatun is to be wired for electric lights, the power for which will be taken from the Panama Railroad Company's plant at Colon.

Electric motors and cranes for Empire shops have been ordered and will soon be installed.

Equipment has been ordered for the electric lighting of the rock-crushing plant at Porto Bello, which is to be operated day and night.

An automatic fire-alarm telegraph system for Commission buildings at Ancon and in the city of Panama is now being ordered.

Specifications were also revised for the construction of a large material-handling plant in connection with the Gatun locks and dams.

BUILDING CONSTRUCTION DIVISION.

During the fiscal year ending June 30, 1907, the organization of the division of building construction was well established, and few changes have been made. A new assistant master builder was appointed in September, 1906, and a supervisor of accounts was added to the organization in February, 1907.

The average force employed during the year has been 3,570 men, the maximum force being 4,168 men, employed in March, 1907, and the minimum force being 2,731 men, employed in July, 1906.

The total expenditures of this division during the fiscal year were: Labor, \$2,560,627.67; material, \$1,796,959.90; total, \$4,357,587.57. The largest single item of expenditures was for quarters for gold employees, which amounted to \$1,432,415.51, including labor and material. The next largest item was for construction of quarters for silver employees, amounting to \$482,502.88, including labor and material. For the construction of hospitals there was expended \$315,196.57, and for supervision and clerical force there was expended \$193,763.73.

During the year the general office for the auditing and disbursing departments was completed at Empire, also a court-house at the same point, and an annex to the administration building at Culebra was commenced. A number of the type houses for occupancy of gold employees have been revised, with the intent of cheapening the cost of construction, so far as is consistent with the reasonable needs of the occupants. The chief changes consisted in the removal of the end porches, double boarding the party walls, and the doubling of second-story floors with waterproof paper between, in quarters occupied by

two or more families. Some new types were designed for residences of officials.

Two hundred and fifty-six quarters for gold employees were constructed, consisting of residences of various types, both bachelor and family quarters.

Quarters were constructed for the accommodation of silver employees, consisting of barracks, bathhouses, cook sheds, family quarters, and kitchens, to a total of 335.

Thirty-three buildings for the sanitary department, for use as hospitals, were constructed during the year, consisting of an insane hospital, leper colony, tuberculosis ward, a new hospital at Colon, 2 sixteen-bed hospitals at Gatun, and a number of other buildings for the same purpose.

A new two-room schoolhouse for white children was constructed at Culebra, and schoolhouses at Gatun, Cristobal, and Empire were commenced.

A machine and car repair shed, machine shop, engine house, pattern shop, and other structures for the manufacture and repair of machinery, amounting to a total of 10, were completed during the year, and extensive shop plants were commenced at Paraiso and Empire.

Seven mess halls for the accommodation of American employees and 11 for European laborers were completed during the year; also a large hotel at Tivoli Hill was completed during the latter part of 1906, together with quarters for help at that point, baggage room, etc.

Four commissaries, sanitary storehouses, and 1 corral were completed during the year, together with coal chutes at Las Cascadas and Pedro Miguel and division offices at Gatun and Ancon. Repairs were made to general offices at Panama, Ancon, Culebra, and Cristobal, at an expense of \$14,735 79; also repairs and alterations to old French buildings, and to new buildings to be occupied as gold quarters at different stations along the Zone were made at an expense of \$176,083.38, together with alterations, improvements, and repairs to buildings throughout the Zone, occupied as quarters for silver employees. In repairs to hospital buildings at various points \$54,172 54 were expended. Several buildings were repaired for school purposes, and a number of buildings occupied as shops were also altered and repaired. A number of old French buildings were turned into mess halls for European employees and repairs made to hotels for the accommodation of American employees.

House No. 1 at Cristobal was remodeled for occupancy as a general office building, and a number of division buildings were repaired during the year. Miscellaneous buildings to the number of 27 were completed, including 8 fire department buildings, 10 jails, and 4 post-office buildings. During the year it was decided to change the residence which was being constructed at Santa Rosa (Ancon), designed to be used as the governor's residence, into a general office building, to be used by the departments of sanitation and civil administration. The expense in constructing miscellaneous buildings was \$210,867.71, a large portion of which was for changes and alterations for the conversion of the last above-mentioned building into an administration building. This building is not yet entirely completed, but the work thereon is steadily progressing.

Four Y. M. C. A. clubhouses have been constructed, at Culebra, Empire, Gorgona, and Cristobal. These houses are large and com-

modious, are in charge of a secretary, and contain billiard tables, bowling alleys, library, rooms for games of all sorts, soda fountain—in fact, everything deemed necessary for the amusement of employees; also two large halls have been completed for church purposes, lodge halls, and meeting places for secret societies.

A building was erected for use as an electric-light plant at Empire, the cost of this structure being \$8,137.22.

Manufacturing plants have been operated by this division at Ancon and Lario. The plant at Ancon consists of a planing mill and a machine and tinmith shop, and has done nearly all the work of that description required by this division and much for outside divisions and departments. The plant at Lario is a planing mill, at which are manufactured sash, doors, and blinds, lumber planed and ripped into other sizes; desks, etc., manufactured for other divisions, together with the work of a general planing mill. An addition was made to this planing mill during the year in order to enlarge its capacity, and it is now running on full time and turning out work rapidly. The amount expended during the year on the manufacturing account was \$276,884.19.

A number of storehouses have been repaired during the year, particularly that situated at Mount Hope, which was destroyed by fire. The work is not yet completed, but is steadily progressing.

Of the 2,265 buildings which were received from the French Canal Company 252 were repaired during the year and 113 were destroyed, leaving a balance of 678 of these buildings yet to be repaired, remodeled, or demolished. A total of 767 new buildings have been constructed during the present fiscal year ending June 30, 1907, and there were on hand on that date 2,919 buildings of all classes.

Material for the work of this division during the year has been received in a fairly prompt manner, but the work has been considerably delayed on account of the want of flooring, ceiling, and siding, which has been difficult to obtain in quantities desired. During the year one entire cargo of lumber was lost at sea, amounting to some 750,000 feet, and another ship containing lumber for the Commission ran on the rocks and 250,000 feet were jettisoned, making a total nondelivery of 1,000,000 feet of lumber at the time the division was greatly in need of it.

The most important points on the Zone in connection with the work of this division have been at the Tivoli Hill, where the new hotel has been erected, together with a number of quarters for white employees and camps for laborers at Culebra, where is located the administration building of the department of construction and engineering, and where a clubhouse, quarters for employees, and residences of officials are located; at Empire, where are located the building of the auditing and disbursing departments, married quarters for gold employees, fire department building, court-house, electric-light plant, laborers' barracks, clubhouse, mess halls, etc.; at Gatun, where construction of dam and locks is in progress, a new village has been completed, and at Gorgona, where is located a Y. M. C. A. clubhouse, hotel, and where a number of quarters for gold and silver employees have been erected, together with a commissary. Six buildings have been started at Porto Bello, some 18 miles from Cristobal, for occupancy as quarters by forces engaged in stone-crusher work at that point, the product for use in masonry work in connection with canal construction.



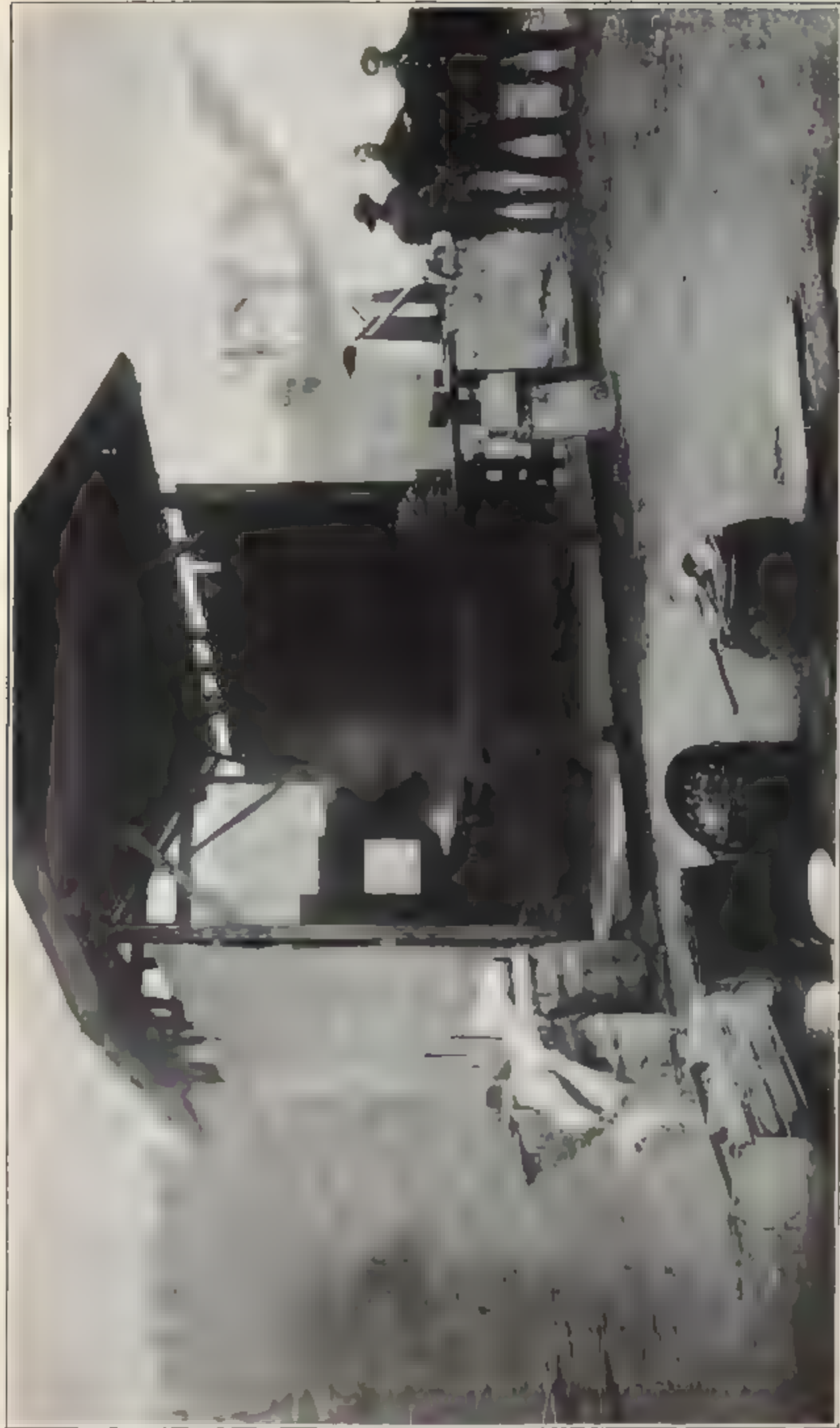
BEDROOM IN FAMILY QUARTERS





TYPICAL CAMP OF NEGRO LABORERS AT PARAISO.





OLD STYLE KITCHEN FOR NEGRO LABOPERS AT COMACHO.



PLATE 106.



NEW STYLE KITCHEN FOR NEGRO LABORERS NEAR GORGONA



The class of skilled labor recruited in the United States has been fairly effective, although in a number of cases men have been sent down as carpenters at the highest rate of wages who proved on trial to be inefficient and were either disrated or discharged. Much of the West Indian labor used in the division has been replaced by European labor. While the hourly rate for European labor is somewhat more the results are much greater than from West Indian labor and have proved more satisfactory.

The following is a list of quarters for gold employees completed during the year:

	Rooms per house.	Number of houses.	Total number of rooms.
Family quarters:			
Type 1.....	10	12	120
Type 3.....	10	2	20
Type 4.....	10	3	30
Type 7.....	6	25	150
Type 8.....	8	5	40
Type 14.....	16	25	400
Type 15.....	3	51	153
Type 17.....	5	31	155
Type 19.....	8	2	16
Type A.....	3	10	30
Type F.....	8	5	40
Special type.....		6	66
Bachelor quarters:			
Type 5.....	8	56	448
Type 16.....	4	12	48
Type 18.....	24	11	264
Total.....		256	1,980

The following new buildings were completed during the year for silver employees:

Range closets.....	70
Cook shed.....	71
Standard S. D. kitchens.....	31
Laborers' barracks.....	124
Laborers' bathhouses.....	24
Family quarters.....	15
Total.....	335

The following is a list of hospital buildings completed:

Type.	Rooms per house.	Number of houses.	Total rooms.
ANCON.			
Bachelors' quarters: Special type.....	45	1	45
Nurses' quarters: Special type.....	34	1	34
Other quarters:			
Type 3.....	10	1	10
Type 13.....	8	6	48
		9	137
COLON.			
Nurses' quarters: Special type.....	49	1	49
Other quarters:			
Type C.....	7	3	21
Type 3.....	10	1	10
Type 13.....	8	1	8
		6	88
Total.....		15	225

The following new mess halls were completed: For gold employees, 8 (including Tivoli Hotel); for silver employees, 11; total, 19.

The following miscellaneous buildings were constructed for the departments of sanitation and civil administration:

Fire department buildings.....	8
Jails.....	10
Church.....	1
Office building.....	1
Post-offices.....	4
Fumigation houses.....	3
Total.....	27

During the year the number of men under the architect has varied, as shown in the following table, and at present consists of 9 draftsmen and an estimator.

1906.		1907.	
July.....	7	January.....	11
August.....	8	February.....	11
September.....	8	March.....	11
October.....	11	April.....	11
November.....	13	May.....	12
December.....	12	June.....	11

There have been prepared during the year 145 finished sets of drawings, consisting of 605 sheets of tracings and bills of material for most of these sets. Below is given a general classification of the drawings:

List of completed plans made during the fiscal year 1906-7.

Classification of drawings.	Complete sets.	Total number of tracings.
Plans of the canal and locks.....	24	95
Plans of the locks.....	14	87
Plans of the locks.....	3	37
Plans of the locks.....	3	17
Plans of the locks.....	7	50
Plans of the locks.....	5	10
Plans of the locks.....	9	31
Plans of the locks.....	5	5
Plans of the locks.....	40	18
Plans of the locks.....	11	45
Plans of the locks.....	1	5
Plans of the locks.....	2	7
Plans of the locks.....	2	12
Plans of the locks.....	7	40
Plans of the locks.....	1	80
Plans of the locks.....	145	605
Plans of the locks.....	1	10
Plans of the locks.....	146	615

The following table shows the total number of employees during the year, with number in service at the end of the fiscal year:

Branch of service.	Dis- charged for cause.	Dis- charged for dis- ability.	Resigned or left the service.	Trans- ferred.	Deaths.	In serv- ice June 30.	Total.
General office, drafting room and general supervision.....	9	5	39	12		154	219
Construction and repair force:							
Foremen.....	11		17	14		74	116
Carpenters.....	189	6	301	30	4	713	1,333
Plumbers.....	41	1	66	3	1	83	196
Painters.....	48		49	2		47	146
Masons.....	5		1			4	10
Bricklayers.....	2	1	3	1		11	18
Plasterers.....	8		10			19	28
Machinists and blacksmiths.....	2		3			7	12
Tinsmiths.....	2		4			1	7
Total.....	317	13	583	62	5	1,104	2,084

Amounts expended account of pay rolls during fiscal year ended June 30, 1907.

For office and supervisory forces, gold rolls.....	\$358,006.95
For skilled labor, gold rolls.....	1,154,671.40
For skilled and unskilled labor, silver rolls.....	1,047,569.80

Total, United States currency..... 2,560,248.15

Average rate of pay, per hour:	Cents.
Gold employee, United States currency.....	60.9
Silver employee, Panamanian currency.....	32.7
All employees, United States currency.....	28.8

Statement of buildings repaired and constructed, demolished, remaining, and totals, from July 1, 1906, to July 1, 1907.

Town or railroad station.	Number on hand July 1, 1906.	Number previously repaired.	Number repaired this year.	Number destroyed.	Balance to be re- paired.	Number previously constructed.	Number constructed this year.	Class of construction.	Number on hand July 1, 1907.
Palo Seco.....							8	Hospital.....	8
Tahoga.....	8	1	1		6		1	Do.....	9
Naos.....	3	1			2				3
Flamenco.....	2								2
Farfan.....	2				3				3
La Boca.....	67	29	7	2	18	11	24	21 quarters, 1 storehouse, 1 fire-department building, 1 mess hall	80
Panama City.....	4	3				1			4
La Seccion.....	24	7	1		16	1			24
Ancon.....	110	46	19	1	25	25	60	45 quarters, 1 mess hall, 4 hospitals, 1 jail, 1 fire-de- partment building, 1 chapel, 2 offices, 1 hotel, 4 miscellaneous.	175
Las Sabanas.....							1		1
Corozal.....	36	25	6			5	18	16 quarters, 2 mess halls..	54
Rio Grande Inferior.....	7				7				7
Butte Cardenas.....	2				2				2
Ecluse 10.....	13				13				13
Miraflores.....	31	28			3				31
Pedro Miguel tank..	21	7			14				21
Ecluse 8.....	11				11				11
Pedro Miguel.....	30	4		3	9	9	24	15 quarters, 3 storehouses, 3 offices, 1 fire-depart- ment building, 1 mess hall, 1 car-repair shed.	51

Statement of buildings repaired and reconstructed, demolished, remaining, and total from July 1, 1946, to July 1, 1947.—Continued.

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Statement of buildings repaired and constructed, demolished, remaining, and totals, from July 1, 1906, to July 1, 1907—Continued.

Town or railroad station.	Number on hand July 1, 1906.	Number previously repaired.	Number repaired this year.	Number destroyed.	Balance to be repaired.	Number previously constructed.	Number constructed this year.	Class of construction.	Number on hand July 1, 1907.
Tabernilla.....	25	22	2	...	...	1	34	28 quarters, 1 jail, 3 mess halls, 1 office, 2 storehouses.	59
Ea. Enterprise.....	16	14	...	2	...	...	...	...	14
San La Voie du kilometer 20	6	...	5	1	...	...	1	1 cook shed.	6
Chagres.....	12	...	...	12	...	...	...	...	12
Prifoles.....	2	2	...	...	...	...	1	1 cook shed.	2
Bohio.....	47	16	4	...	27	...	...	...	47
Chagres.....	33	...	...	...	33	...	...	...	33
New Town.....	1	...	...	...	1	...	...	...	1
Derivation 4.....	5	...	...	...	5	...	...	...	5
Ecluse 1.....	18	...	...	...	18	...	...	...	18
Derivation 3.....	3	...	...	...	3	...	...	...	3
Penas Blancas Arriba.....	3	...	...	...	3	...	...	...	3
Penas Blancas, Q. L.....	7	...	...	...	7	...	...	...	7
Vamos Vamos.....	1	...	...	...	1	...	...	...	1
Gatun.....	5	1	...	...	4	...	92	73 quarters, 1 jail, 2 mess halls, 8 storehouses, 3 offices, 1 hospital, 4 miscellaneous.	97
Mindi.....	3	...	...	...	3	...	...	...	3
Mount Hope.....	20	5	2	...	12	1	4	1 jail, 2 quarters, 1 boiler house.	24
Cristobal and Fox River.	249	121	8	5	96	19	74	61 quarters, 2 hospitals, 3 storehouses, 1 jail addition, 1 fire department building, 2 shops, 1 clubhouse, 1 lodge hall, 1 office, 1 hand stand.	318
Total.....	2,265	1,015	252	113	678	204	767		2,919

Palo Seco.—The following buildings were completed during the year: Leper colony, 8 buildings. The lepers were removed from Miraflores to Palo Seco in the early part of 1907.

Taboga.—Repairs were made to the sanitarium laundry. The following new building was completed:

N-1941, sanitarium storehouse.

La Boca.—Seven buildings were repaired for occupancy as quarters, mess hall, and office. The following construction work was completed during the year:

N-1264, 2 water-closets.

N-1265 fire department building.

N-1266, 1 range closet.

N-1267, 2 cook sheds.

N-1268, 10 standard laborers' barracks, No. 2 (Sosa Hill).

N-1269, 1 standard laborers' kitchen, S. D.

N-1270, Gallegos' mess hall and kitchen.

N-1271, tool house.

N-1272, 3 range closets (Sosa Hill).

N-1273, laborers' bath-house (Sosa Hill).

Division office building at Sosa Hill was commenced on May 7, 1907, and was 70 per cent complete on July 1, 1907.

Ancon.—Nineteen buildings were repaired for occupancy as quarters, mess hall, and hospital purposes. The following new buildings were completed during the year:

- N-14, bachelor quarters, sanitary department.
- N- 9, insane hospital used for other hospital cases.
- N-17, tuberculosis ward.
- N-18, nurses' quarters.
- N-20, ward maids' quarters.
- N-29, six type 13 houses.
- N-30, jail.
- N-31, pump house.
- N-32, boiler house.
- N-35, bath and toilet room.
- N-36, fire department building.
- N-37, kitchen for jail.
- N 39, second story to wards Nos. 18 and 19.
- N-40, one cook shed.
- N-41, chapel.
- N-46, four standard laborers' barracks No. 2 (leper camp).
- N-47, one standard laborers' kitchen, S. D. (leper camp).
- N 48, laborers' bath house (leper camp).
- N-49, one range closet.
- N 50, galley, mess hall and kitchen.
- N 51, six standard laborers' barracks No. 2 (Fort Tivoli Hill).
- N 52, fifty-two laborers' bath houses (Fort Tivoli Hill).
- N 53, one range closet.
- N-59, one type No. 3 house.
- N 60, building department office and storeroom.
- N 65, one type 15 house.
- N-72, sick camp (camp No. 2).

In addition to the above, several buildings to be used for insane asylum are partially completed. Also many quarters for gold employees and several new buildings for hospital purposes.

La Section -Repairs were made to one building occupied as quarters.

Santa Rosa. It was decided during the year to convert new residence being constructed for the governor into an administration building. Work on same has been prosecuted throughout the year and the building was 47 per cent complete July 1, 1907.

Tivoli Hill. The large hotel at this place, 170 by 315 feet, was completed during the year. The following buildings were constructed in the vicinity of the hotel within the past year:

- N-33, one type 17 house.
- N-34, three quarters for hotel help.
- N 42, one type 8 A house.
- N-43, two type 19 improved No. 1 houses.
- N 44, six type 17 houses.
- N 45, two type 5 houses.
- N-54, hotel, storeroom, and cabinet shop.
- N 55, hotel waiters' and baggage room.
- N-56, hotel help quarters (2 stories).
- N 57, L. Q. & S. and sanitary department office building.

Three portable houses were moved and repaired.

Las Sabanas -New jail erected to conform with agreement made with the Panamanian Government was completed during the year.

Panama. Repairs were made to the administration building and American legation building. Work on Santo Tomas Hospital was continued throughout the year, an additional appropriation of \$7,451 being made November 1, 1906. The work is now nearly complete.

Corozal.—Six buildings were repaired for use as quarters, post-office, and jail. The following new buildings were completed:

- N-457, laborers' bath house.
- N-458, three range closets.
- N-459, two cook sheds.
- N-460, Gallegos' mess hall and kitchen.
- N-461, one standard laborers' kitchen, S. D.
- N-463, five standard laborers' barracks, No. 2.
- N-464, one standard laborers' kitchen, S. D.
- N-465, Gallegos' mess hall and kitchen.
- N-466, two range closets.
- N-467, laborers' bath house.

Pedro Miguel.—The following new buildings were completed during the year:

- N-1809, post-office.
- N-1810, mess hall.
- N-1811, coal chute.
- N-1812, four type 16 houses.
- N-1813, ten type 17 houses.
- N-1814, laborers' bath house.
- N-1816, fire department building.
- N-1817, one standard laborers' barracks.
- N-1818, six range closets.
- N-1819, cement storehouse.
- N-1820, plumbers' storehouse.
- N-1821, building superintendent's office.
- N-1824, two standard laborers' kitchens, S. D.
- N-1825, car-repair shed.
- N-1828, yardmaster's office.

Paraiso.—Repairs to six buildings used for occupancy as quarters, storehouses, office, and jail. The following new buildings were completed during the year:

- N-1712, ten houses, type A, family quarters, negro mechanics.
- N-1713, five houses, type F, white family quarters.
- N-1714, one bachelor quarters, type 5.
- N-1717, one type 1 house.
- N-1719, sixteen-bed hospital.
- N-1722, ten type 15 houses.
- N-1723, three range closets.
- N-1724, three cook sheds.
- N-1725, laborers' bath house.
- N-1726, mess hall.
- N-1727, commissary.
- N-1728, one standard laborers' kitchen, S. D.
- N-1729, two type 5 houses.
- N-1730, one range closet.
- N-1739, fire department building.

N-1742, one laborers' family quarters.

An extensive shop plant is now in progress of construction.

Carthagencita.—The following new buildings were completed during the year:

- N-1720, four cook sheds.
- N-1721, three range closets.
- N-4000, one standard laborers' kitchen, S. D.

Cucaracha.—Repairs were made to one building used as pump house. The following new buildings were completed during the year:

- N-502, tool shed for sanitary department.
- N-503, laborers' bath house.
- N-504, three cook sheds.
- N-505, two range closets.
- N-506, Gallegos' mess hall and kitchen.
- N-507, one standard laborers' kitchen, S. D.

Rio Grande.—Eight buildings were repaired for occupancy as quarters, mess hall, sick camp, and air-compressor plant. The following new buildings were completed during the year:

- N 1923, five laborers' camps.
- N 3590, mule stable.
- N 3591, laborers' bath house.
- N 3592, two range closets.
- N 1925, four closets.
- N 1927, ten cook sheds.
- N-1933, two standard laborers' kitchens, S. D.

Enterprise.—The following new buildings were completed during the year:

- N 1150, four family quarters (negro mechanics).
- N 1152, one range closet.
- N 1923, eight laborers' barracks.

Gold Hill. Repairs were made to three buildings occupied as quarters. The following new buildings were completed during the year:

- N-585, kitchen.
- N 586, bath house.
- N 607, engine house.
- N 620, dynamite magazine.
- N-611, Gallegos' mess hall and kitchen.
- N-613, double dry closet.

Culebra.—Repairs to six buildings used as quarters, hospital purposes, storehouses, hotel, etc., were made. The following new buildings were completed during the year:

- N 558, corral annex.
- N 567, one house, type 4.
- N 568, one house, type 5.
- N-570, two houses, type 7.
- N 571, one house, type 8.
- N 576, seven houses, type 14.
- N 578, assistant chief engineer's house.
- N 582, fifteen type, 15 houses.
- N 584, band stand.
- N 587, fire department building.
- N 588, three houses, type 5.
- N-589, ten houses, type 15.
- N-598, hotel laundry.
- N 599, club house.
- N-600, two quarters for hotel help.
- N-601, motor-car house.
- N 602, fumigation building.
- N 603, schoolhouse.
- N 608, one type, 8 A house.
- N 609, six type, 14 houses.
- N-610, five type, 18 dormitories.
- N 614, lodge hall.
- N-615, hospital addition.
- N-617, oil house.
- N-619, lock up (new Culebra).

Work is under way on annex to the present administration building at Culebra.

Lirio.—The following new buildings were completed during the year:

- N 3001, planing-mill addition.
- N-3002, two cook sheds.
- N 3003, two standard laborers' kitchens, S. D.



WESTERN ALFEN FOR EUROPEAN ABIGERS

Rio Grande.—Eight buildings were repaired for occupancy as quarters, mess hall, sick camp, and air-compressor plant. The following new buildings were completed during the year:

- N-1923, five laborers' ramps.
- N-3500, mule stable.
- N-3501, laborers' bath house.
- N-3502, two range closets.
- N-1925, four closets.
- N-1927, ten cook sheds.
- N-1933, two standard laborers' kitchens, S. D.

Enterprise.—The following new buildings were completed during the year:

- N-1150, four family quarters (negro mechanics).
- N-1152, one range closet.
- N-1923, eight laborers' barns.

Gold Hill. Repairs were made to three buildings occupied as quarters. The following new buildings were completed during the year:

- N-585, kitchen.
- N-586, bath house.
- N-607, engine house.
- N-620, dynamite magazine.
- N-611, Gallegos' mess hall and kitchen.
- N-613, double dry closet.

Culebra. Repairs to six buildings used as quarters, hospital purposes, storehouses, hotel, etc., were made. The following new buildings were completed during the year:

- N-558, corral annex.
- N-567, one house, type 4.
- N-568, one house, type 5.
- N-570, two houses, type 7.
- N-571, one house, type 8.
- N-576, seven houses, type 14.
- N-578, assistant chief engineer's house.
- N-582, five of type 14 houses.
- N-584, hand stand.
- N-585, fire department building.
- N-588, three houses, type 5.
- N-589, ten houses, type 15.
- N-598, food laundry.
- N-599, club house.
- N-600, two quarters for hotel help.
- N-601, motor car house.
- N-602, immigration building.
- N-603, tool house.
- N-608, one type 8 A house.
- N-609, six type 14 houses.
- N-610, five type 18 dormitories.
- N-611, bare hut.
- N-612, hospital kitchen.
- N-613, bath.
- N-614, bed up (new Culebra).

Work is under way on annex to the present administration building at Culebra.

Lario. The following new buildings were completed during the year:

- N-3001, planing-mill addition.
- N-3002, two cook sheds.
- N-3003, one standard laborers' kitchen, S. D.
- N-3006, yardmaster's office (cableway).



MESS-HALL KITCHEN FOR EUROPEAN LABORERS.





MESS HALL FOR EUROPEAN LABORERS AT GOLD HILL.





INTERIOR OF MESS HALL FOR EUROPEAN LABORERS AT GOLD HILL.





TYPICAL CAMP FOR EUROPEAN LABORERS AT JUAN GRANDE.

PLATE 111.



TYPE NO 13, ONE-FAMILY HOUSE AT ANCON.





NURSES' QUARTERS AT ANCON.





RECEPTION HALL, NURSES' QUARTERS AT ANCON



PLATE 114.



FIRE COMPANY AND HOUSE AT ANCUM





L. C. C. HOTEL AT CULBERRA.





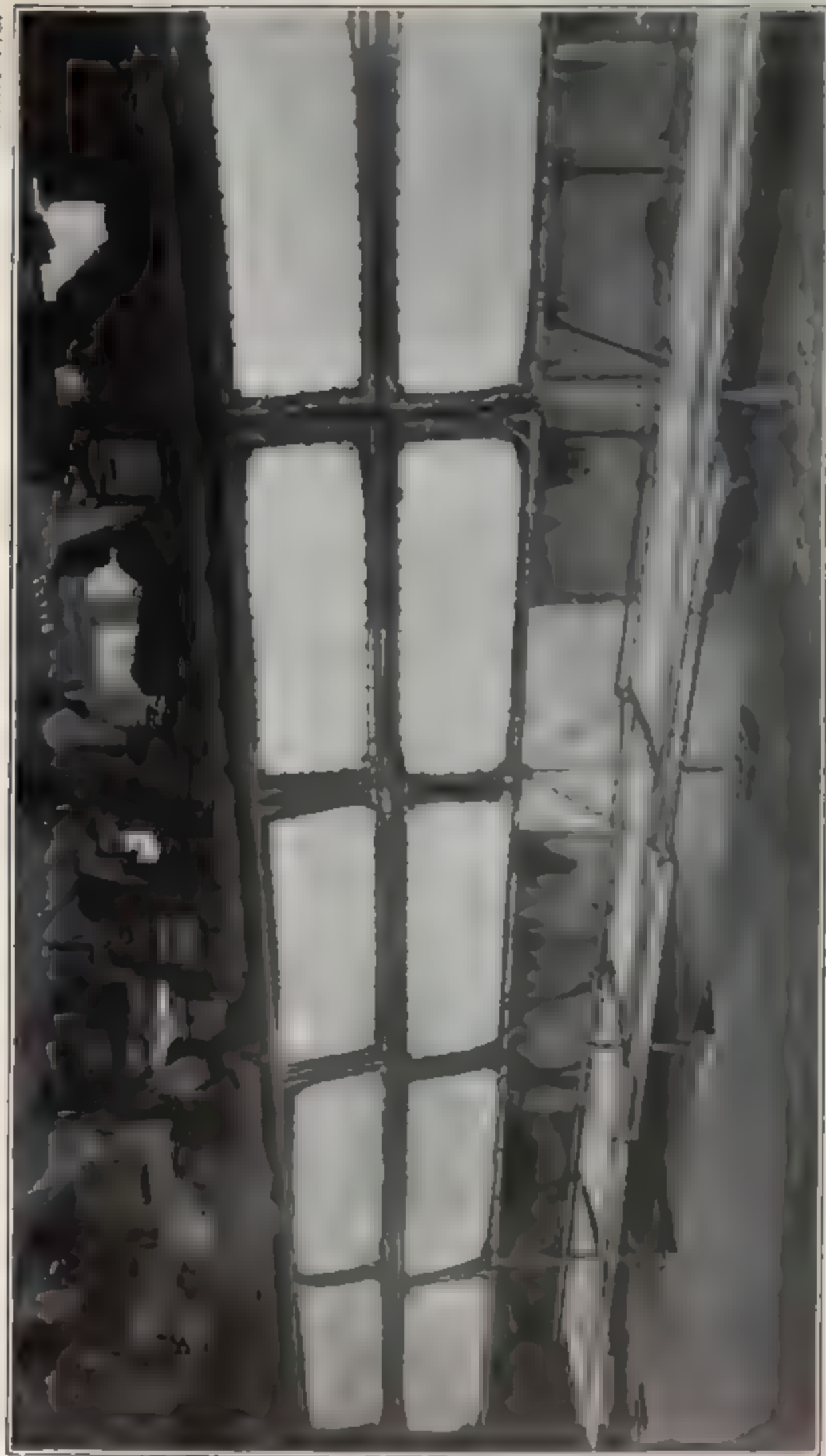
TYPE NO. 15, ONE-FAMILY HOUSE AT CULEBRA





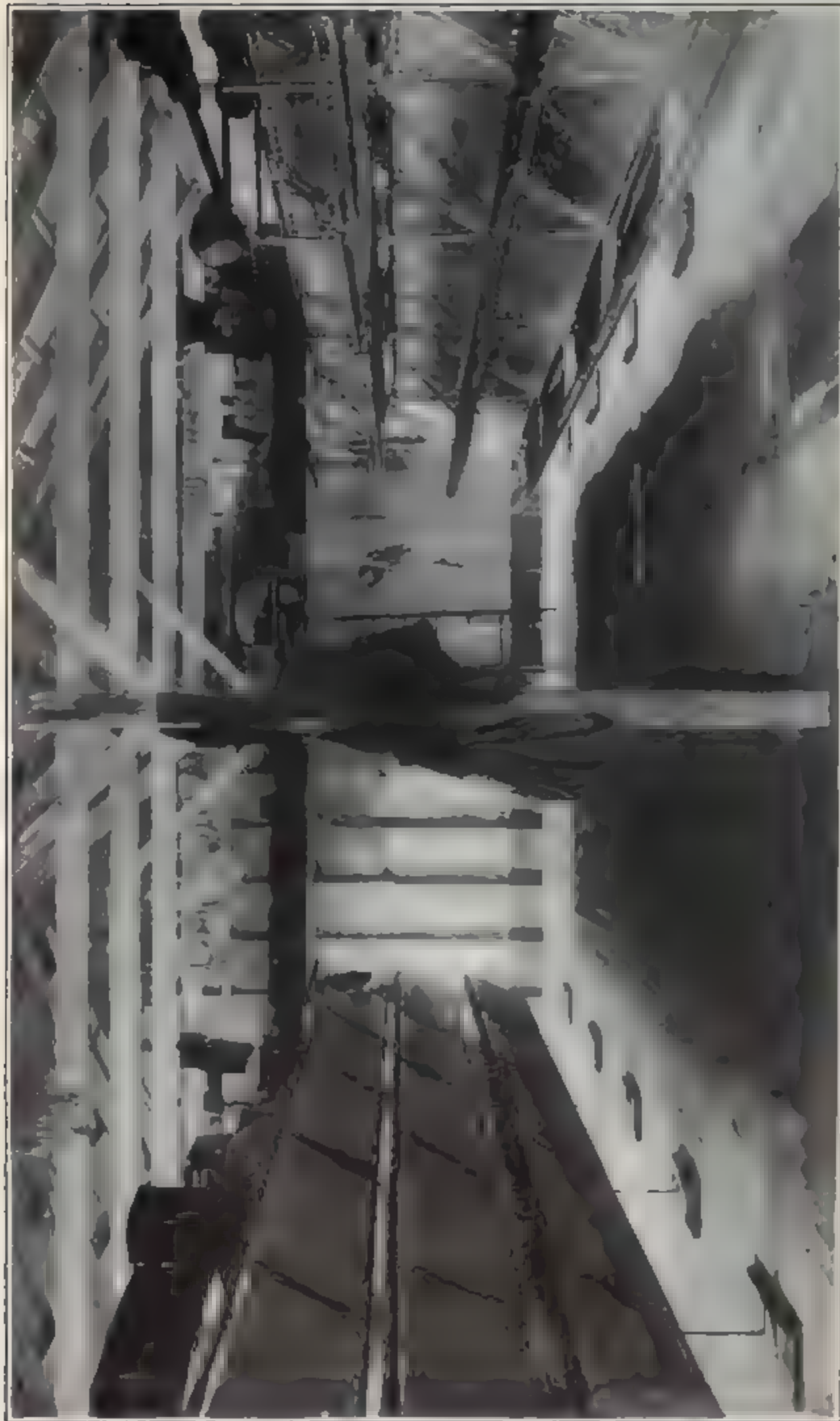
TYPICAL FAMILY QUARTERS FOR NEGRO EMPLOYEES.





THE GREAT HALL OF THE PARLIAMENT BUILDING





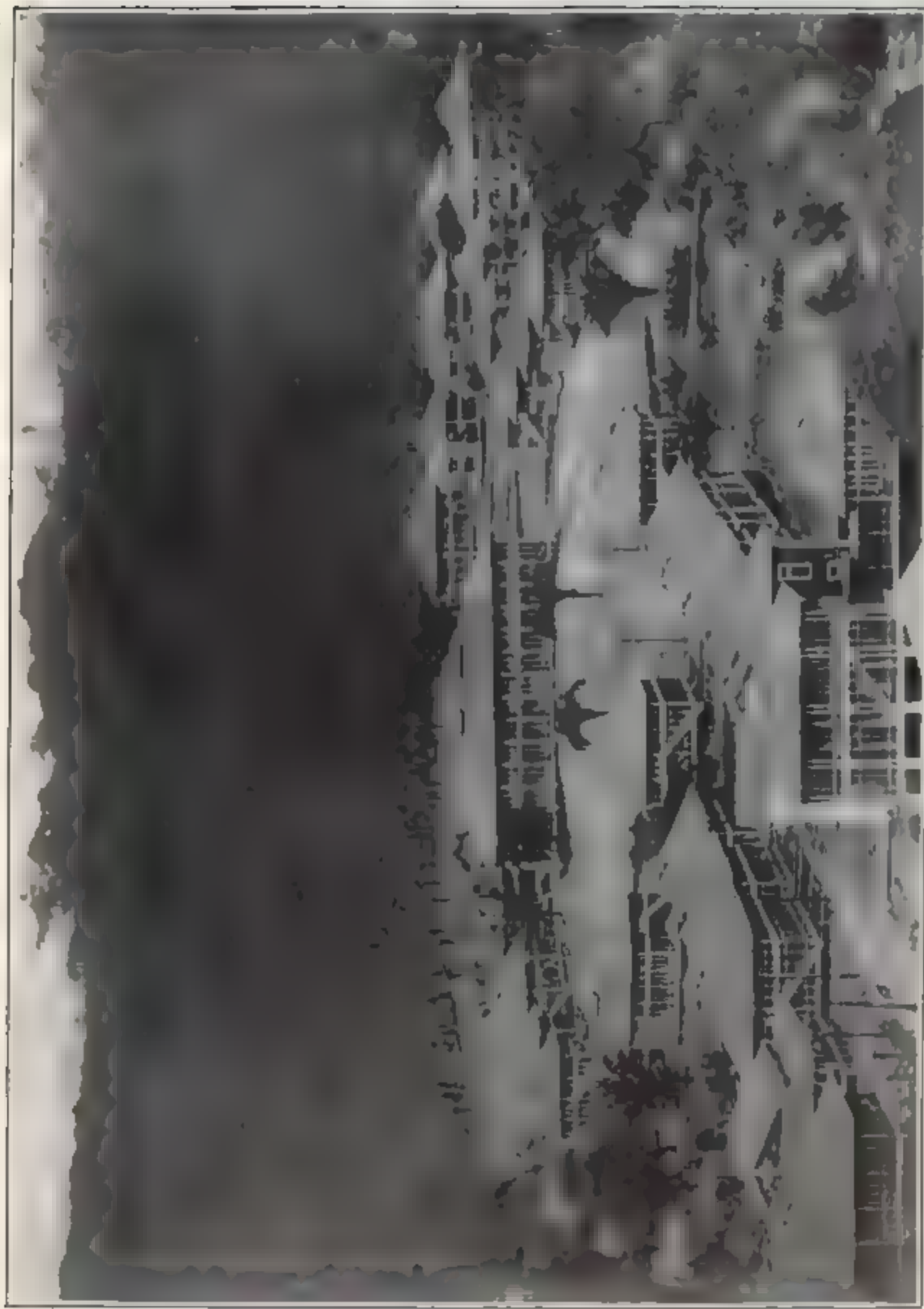
SLEEPING QUARTERS FOR EUROPEAN LABORERS.





TYPE NO. 17 ONE FAMILY HOUSE AT EMPIRE





DISBURSING OFFICE AND QUARTERS AT EMPIRE





Y. M. C. A. CLUBHOUSE AT CULEBRA





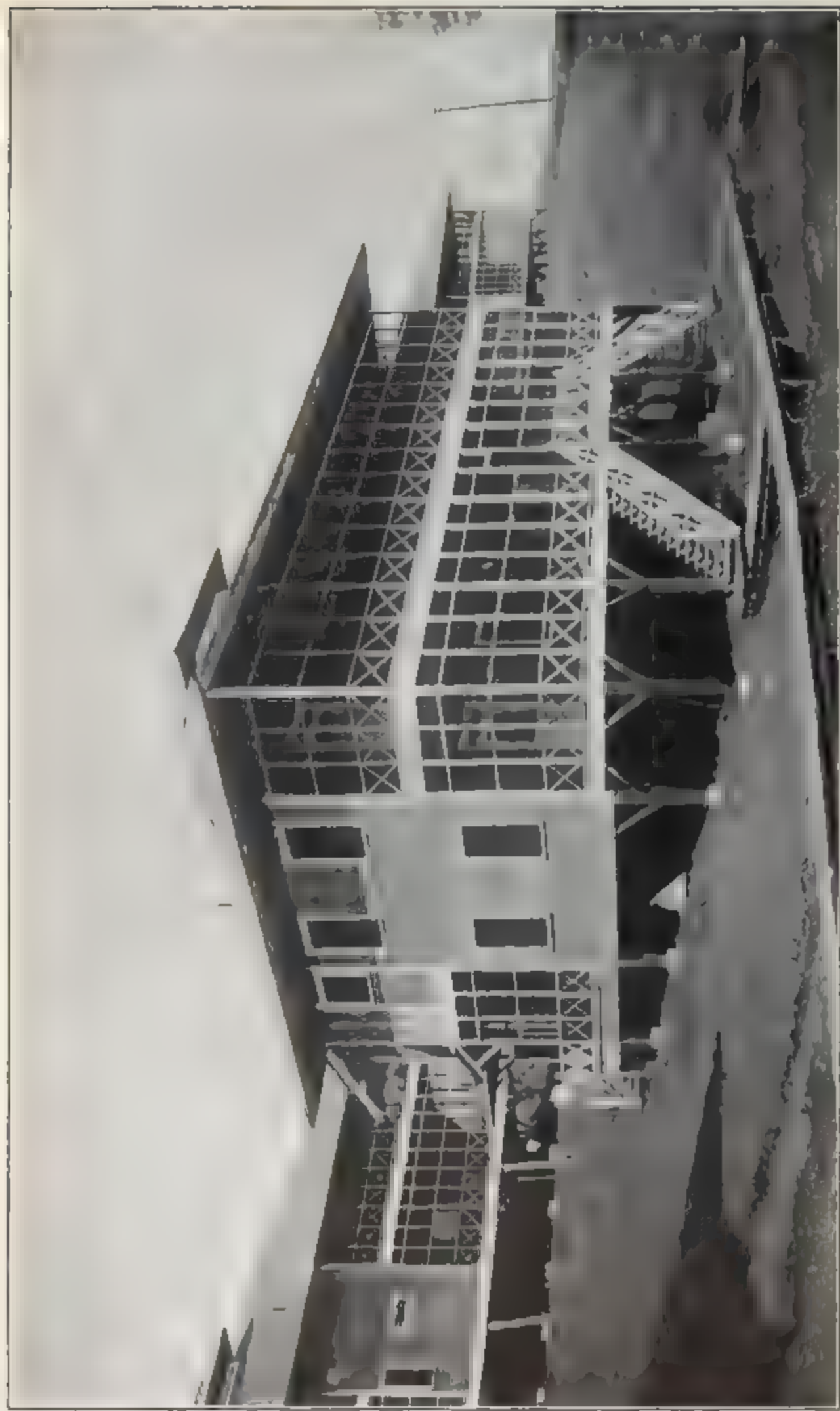
LOBBY, Y M C A. CLUBHOUSE AT CRISTOBAL





CARD AND SMALL GAME ROOM, Y. M. C. A. CLUBHOUSE AT CRISTOBAL





TYPE NO. 8, ONE-FAMILY HOUSE AT CULEBRA.





CHIEF ENGINEER'S RESIDENCE. ADMINISTRATION BUILDING, AND BACHELOR QUARTERS AT CULEBRA.





TYPICAL LABOR TRAIN.





COLERA PENITENTIARY



Cerro.—The following new buildings were completed during the year:

- N-3580, bath house.
- N-3581, closet.
- N-3582, white police officers' quarters.

Empire.—Repairs were made to seven buildings used for occupancy as quarters, storehouses, church, and air-compressor plant. The following new buildings were completed during the year:

- N-1000, new jail.
- N-1009, auditing and disbursing offices.
- N-1010, one house, type 5.
- N-1011, two family quarters, type 14.
- N-1013, one type 3 house.
- N-1014, court-house, second judicial district.
- N-1015, two type 4 houses.
- N-1016, six type 7 houses.
- N-1017, two type 5 houses.
- N-1018, cook shed.
- N-1019, pump keeper's residence (Camacho).
- N-1020, three type 5 houses.
- N-1022, mess hall.
- N-1024, fire-department building.
- N-1026, one range closet.
- N-1027, five type 5 houses.
- N-1028, one standard laborers' barracks.
- N-1031, post-office.
- N-1032, clubhouse.
- N-1033, electric light plant building.
- N-1034, one standard laborers' barracks.
- N-1035, silver mess kitchen.
- N-1036, four type 17 houses.
- N-1038, six type 7 houses.
- N-1039, ten type 5 houses.
- N-1040, cement storehouse.
- N-1042, hotel laundry.
- N-1057, corral.
- N-1058, office building (new shops).
- N-1059, ice platform.
- N-1062, motor car house.
- N-1064, fumigation house.

An extensive shop plant is being constructed. Also many houses for gold employees.

Cunette.—Repairs were made to two buildings for occupancy as quarters. The following new buildings were completed during the year:

- N- 596, four range closets.
- N- 597, four cook sheds.
- N-4020, one standard laborers' kitchen, S. D.

Casa Blanca.—Sixteen buildings were repaired in this encampment for occupancy as quarters. The following new buildings were completed during the year:

- N- 595, two cook sheds.
- N-4010, one standard laborers' kitchen, S. D.

Las Cascadas.—Repairs were made to thirteen buildings used for occupancy as quarters, offices, and hospital. The following new buildings were completed during the year:

- N-1502, machine shop.
- N-1503, oil house.
- N-1504, engine house.
- N-1505, coal chute.

- N 1506, mess hall.
- N 1507, seven type 16 houses.
- N 1508, ten type 15 houses.
- N 1510, air compressor plant.
- N 1511, one cook shed.
- N 1512, standard laborers' kitchen, S. D.
- N 1513, two type 18 enclosures.
- N 1514, ten type 7 houses.
- N 1515, white laborers' bath house.
- N 1517, pump shed.
- N 1518, hotel laundry.
- N 1519, one range closet (sheds).
- N 1520, hotel boiler shed.
- N 1521, post-office.

Buena Vista.—Repairs were made to thirteen buildings used for occupancy as quarters, mess hall, and pump shed. The following new buildings were completed during the year:

Two cook sheds.

San Obispo.—Repairs were made to twenty-two buildings used for marine encampment, mess hall, laborers' quarters, etc. The following new buildings were completed during the year:

- N 3101, ammunition storehouse.
- N 3102, three range closets.
- N 3103, five cook sheds.
- N 3104, one standard laborers' kitchen, S. D.
- N 3105, laborers' bath house.

San Obispo.—Repairs were made to five buildings used for occupancy as quarters and church. The following new buildings were completed during the year:

- N 152, jail.
- N 151, mail stable.
- N 150, commissary.

San Juan.—Repairs were made to two buildings used for occupancy as quarters and sick camp. The following new buildings were completed during the year:

- N 100, silver mess kitchen.
- N 102, College mess hall and kitchen.
- N 100, laborers' bath house.
- N 101, five range closets.
- N 102, five cook sheds.
- N 100, hydrographer's house.

Chicoas.—The following new buildings were completed during the year:

- N 100, silver mess kitchen.
- N 102, College mess hall and kitchen.
- N 100, laborers' bath house.
- N 101, five range closets.
- N 102, five cook sheds.
- N 100, hydrographer's house.

San Juan.—Repairs were made to one building occupied as quarters. The following new building was completed during the year:

- N 100, silver mess kitchen.

San Juan.—Repairs were made to five buildings used for occupancy as quarters, mess hall, and post office. The following new buildings were completed during the year:

- N 100, silver mess kitchen.
- N 102, College mess hall and kitchen.

Santa Cruz.—This encampment was ordered repaired in January, 1907, and forty-three houses have been repaired during the fiscal year; also one standard laborers' kitchen, S. D., was constructed.

Bas Matachin.—Repairs were made in seven buildings used for occupancy as quarters, shops, and storehouses. The following new buildings were completed during the year:

- N-113, pattern and car machine shop.
- N-114, addition to car repair shop.
- N-116, five colored family quarters.
- N-117, two cook sheds.
- N-118, bar iron rack.
- N-119, instrument repair shop.
- N-122, three standard laborers' barracks No. 2.
- N-124, laborers' bath house.

Gorgona.—Repairs were made to 14 buildings used for occupancy as quarters, schoolhouse, storehouses, church, etc. The following new buildings were completed during the year:

- N-1181, jail.
- N-1182, three houses type 1.
- N-1184, four type 1 houses.
- N-1185, two-room addition to house No. 46.
- N-1186, pump keeper's residence.
- N-1187, mess hall.
- N-1188, six type 5 houses.
- N-1189, corral.
- N-1190, fire department building.
- N-1191, hotel-help quarters, No. 1.
- N-1192, band stand.
- N-1193, hotel laundry.
- N-1194, plumbers' storehouse
- N-1195, clubhouse.
- N-1197, commissary.
- N-1198, five type 5 houses.
- N-1199, one type 15 house.
- N-1200, cement storehouse.
- N-1201, hotel-help quarters, No. 2.
- N-1202, one type 5 house.
- N-1204, two type 18 dormitories.
- N-1205, three type 14 houses.
- N-1206, one type 7 house.

Caballo Viejo.—Repairs were made to four buildings used for occupancy as quarters. The following new buildings were completed during the year:

- N- 592, laborers' bath house.
- N- 593, closet and bath.
- N-3250, three range closets.
- N-3251, three cook sheds.
- N-3252, silver mess kitchen.
- N-3253, two standard laborers' kitchens, S. D.

Juan Grande.—Work repairing this encampment was started during the year and 10 buildings were repaired, used for occupancy as quarters and mess hall. The following new buildings were completed during the year:

- N-1196, one cook shed.
- N-3500, silver mess kitchen.
- N-3501, Gallegos' mess hall and kitchen.
- N-3502, laborers' bath house.
- N-3503, one range closet.

Mamei.—Repairs were made to two buildings used for occupancy as quarters. The following new buildings were completed during the year:

- N-3300, three cook sheds
- N-3302, Gallegos' mess hall and kitchen.
- N-3303, one type 14 house.
- N-3304, laborers' bath house.

San Pablo.—Seven buildings were repaired for occupancy as quarters. The following new buildings were completed during the year:

- N-2000, jail.
- N-3350, one cook shed.

Tabernilla.—Repairs were made to two buildings for occupancy as quarters. The following new buildings were completed during the year:

- N-2020, jail.
- N-3026, yard-master's shanty.
- N-3027, three range closets.
- N-3028, three standard laborers' barracks.
- N-3029, two laborers' bath houses.
- N-3031, Gallegos' mess hall and kitchen.
- N-3451, four cook sheds.
- N-3452, sand house.
- N-3453, 10 standard laborers' barracks.
- N-3454, one type 5 house
- N-3455, two standard laborers' kitchens, S. D.
- N-3456, two laborers' bath houses.
- N-3457, mess hall.
- N-3459, tool house.
- N-3460, hotel-help quarters.

Sin la Voie.—Five buildings were repaired for occupancy as quarters. The following new building was completed during the year:

- N-3540, one cook shed.

Triples.—The following new building was completed during the year:

- N-4070, one cook shed.

Bohio.—Repairs were made to four buildings used for occupancy as quarters.

Gatun. As soon as it was decided to build a lock canal five type 5 houses were ordered built, which order was followed up with orders for a great number of houses of various types and for various purposes. The following buildings were completed during the year:

- N-1165, jail type A.
- N-1166, kitchen.
- N-1168, five type 5 houses.
- N-1169, ten type 17 houses
- N-1170, twenty laborers' barracks
- N-1171, mess hall.
- N-1172, planters' storeroom
- N-1173, cook shed and storeroom
- N-1174, water tower.
- N-1175, hotel-help quarters No. 1.
- N-1176, tool house.
- N-1177, pay office.
- N-1178, five type 5 houses
- N-1179, five type 11 houses.

N-4030, one type 8 house.
N-4031, ten standard laborers' barracks.
N-4032, two standard laborers' kitchens, S. D.
N-4033, office building, division engineer.
N-4034, Gallegos mess hall and kitchen.
N-4035, twenty-four-bed hospital.
N-4036, five colored family quarters.
N-4040, post-office.
N-4041, commissary.
N-4042, one standard laborers' kitchen, S. D. (spillway).
N-4043, two standard laborers' barracks (spillway).
N-4044, powder house.
N-4045, one type 8 house.
N-4046, one type 18 dormitory.
N-4048, hotel-help quarters No. 2.
N-4049, fluviograph house.
N-4051, fumigation room.
N-4052, one laborers' bath house.
N-4053, tool house (spillway).
N-4059, cement shed.
N-4060, sand-drying plant.
N-4061, distilling shed.
N-4062, paint shop.

Mount Hope.—Repairs were made to two buildings used for occupancy as repository and church. The following new buildings were completed during the year:

N- 304, boiler house.
N-1701, new jail.
N-1702, pump keeper's residence.
N-1703, one type 15 house.

The large warehouse belonging to material and supplies department was partially destroyed by fire and is now being rebuilt.

Cristobal.—Repairs were made to eight buildings used for occupancy as quarters, schoolhouse, church, and office. The following new buildings were completed during the year:

N-264, jail, addition.
N-284, three type 1 houses.
N-286, two 2-story dormitories.
N-287, one house type 1.
N-288, one house type 3.
N-289, twenty-four standard laborers' barracks.
N-298, fire department building.
N-302, band stand.
N-308, ten range closets.
N-309, three cook sheds.
N-311, one 24-room dormitory.
N-312, two type 14 houses.
N-313, clubhouse.
N-314, deck house on old barge (gold).
N-318, carpenter shop.
N-319, three standard laborers' kitchens, S. D.
N-321, bakery storeroom.
N-322, lodge hall.
N-323, machine-shop extension (dry dock).
N-324, time-keeping office.

House No. 1 is being remodeled to provide room for dispensary and court room.

Colon.—The following new buildings were completed for sanitary department:

- N-262, new hospital on coral reef.
- N-265, three family quarters, type C.
- N-294, one type 3 house.
- N-299, sanitary department storehouse.
- N-300, nurses' home.
- N-306, orderlies' quarters.
- N-307, maids' quarters.
- N-317, boathouse.

Porto Bello.—The following buildings have been started, to be used for occupancy as quarters by forces employed in stone-crusher work at that point:

- N-4080, two standard laborers' barracks No. 2.
- N-4081, one standard laborers' kitchen, S. D.
- N-4082, one type 17 house.
- N-4083, one type 5 house.

APPENDIX D.

REPORT OF THE HEAD OF THE DIVISION OF MATERIAL AND SUPPLIES.

CRISTOBAL, CANAL ZONE, *August 8, 1907.*

SIR: I have the honor to submit herewith the annual report of the division of material and supplies, Isthmian Canal Commission, Canal Zone, for the fiscal year July 1, 1906, to June 30, 1907.

The work of the division of material and supplies during the past fiscal year has been a general continuation of reorganization and consolidation features inaugurated during the fiscal year 1905-6. Material has been received by purchase to the value of approximately \$9,500,000, of which over 90 per cent covers purchases made in the United States. Disbursements during the past fiscal year amounted to \$9,000,000, an average monthly disbursement of \$750,000, of which \$230,000 represents value of material from old French stock.

New storehouses are under construction at Empire and Paraiso shops. At present we are utilizing the old French buildings at both of those places, but the business has been growing so rapidly that they have become entirely inadequate, necessitating the building of new storehouses, which will be located convenient to the new shops and of sufficient capacity to handle the present and anticipated business. In addition to the new storehouses, authority has been granted to erect 10 powder magazines, which are to be constructed of cement to make them fireproof, for the storage of explosives and to safeguard against the danger of having large quantities of explosives stored in only 2 magazines as at present. These will be located at different points on the Zone convenient for the work.

New corrals for our land transportation have been built at Gatun, Gorgona, Bas Obispo, Empire, and Culebra.

A disastrous fire occurred at Mount Hope general storehouse on April 1 of this year, practically destroying one-half of the building and resulting in the loss of material aggregating in value about \$100,000. The fire broke out within a few minutes after the force left the building at the noon hour, and was supposed to have been caused either by sparks from a locomotive or smoking. Practically no delay was occasioned to the work on account of this fire, as a general stock was distributed over the Isthmus at different stores, so that we had sufficient material left on hand and on order to keep everything going until a new supply could be received from the States. Immediately after the fire, work was commenced clearing away the debris, sorting out salvage, and rebuilding the storehouse. The new building has been divided into three sections, with fire walls extending from the ground to the roof, so that should another fire occur there would be no difficulty in confining it between two walls.

The demand for building materials and supplies of all kinds, including construction supplies and equipment, has been heavy, constant, and urgent. During the past fiscal year the division of material and supplies has received 37 full cargoes of material and part cargoes from about 150 ships. Among other items handled there were 23,300,000 feet of lumber, 254,000 cross ties, 4,000 piles, and about 50,000 tons of miscellaneous cargo. We have also disposed of nearly 11,000 tons of scrap French material by sale to dealers in the United States, about 4,000 tons being shipped north as ballast for Panama Railroad boats when they were short of full cargoes of commercial freight. We have also used a large amount of scrap cast iron and scrap brass from the French stock, in our foundries at Gorgona shops, in connection with the work. A large amount of French material, consisting of boilers, pumps, Decauville track, cars, locomotives, cranes, and other material, has been put into use.

Our printing plant in Panama has been running to its full capacity, 14 printing presses being kept busy, besides the book-binding department. About 24,000,000 pieces of printed matter have been turned out during the year. In addition to the printing required by the Commission, a large proportion of the printing required by the Panama Railroad has been done by our plant in Panama.

The estimate of expenditure for the division of material and supplies for the fiscal year 1906-7 was \$943,897.24, but our expenditure was \$755,321.89, being \$188,575.35 under the estimate. The number of gold employees in this division is 252; silver, or colored employees, not including laborers, 534; colored laborers, 503; total, 1,289.

The organization is as follows:

At Cristobal are located the headquarters of the chief of the division and the general offices of the division. In this office is handled all the clerical work in connection with the accounting of material and in ordering material and supplies from the States; also the placing of orders for supplies to be shipped from the storehouses to the various divisions on approved requisitions, or local purchases to be made from the Panama Railroad and Panama Railroad commissary, or on the Isthmus. All United States bills are handled at this office, and all papers in connection with shipments coming from the United States, such as disposition of material, arranging for its inspection, accomplishing bills of lading and dealers' invoices. All accounting work in connection with the issue of material and supplies is handled here, such as reports for the auditor, stock records, etc.

At Mount Hope is located the general storehouse, at which point a stock of standard material and supplies is carried, and from this storehouse the substores at the different points receive their supplies to replenish their stocks, and the various departments on the Isthmus receive a part of their supplies direct.

All material and supplies arriving on the Isthmus, except lumber, piling ties, rail and rolling stock, is received and checked at Mount Hope store.

Substores are located at dry dock (which is at Cristobal and is under the jurisdiction of the storekeeper at Mount Hope) Gorgona, Bas Ojispo, Empue, Culebra, Paraiso, Ancon, La Boca, and the printing plant and stationery department in the administration building, Panama.

The storekeeper at Gorgona has jurisdiction over the district *between Gatun and Gorgona* and furnishes all material and supplies

PLATE 128.



OFFICE BUILDING, DIVISION OF MATERIAL AND SUPPLIES, AT CRISTOBAL.



REC





MOUNT HUPE STOREHOUSE AS SEEN FROM THE S.W.

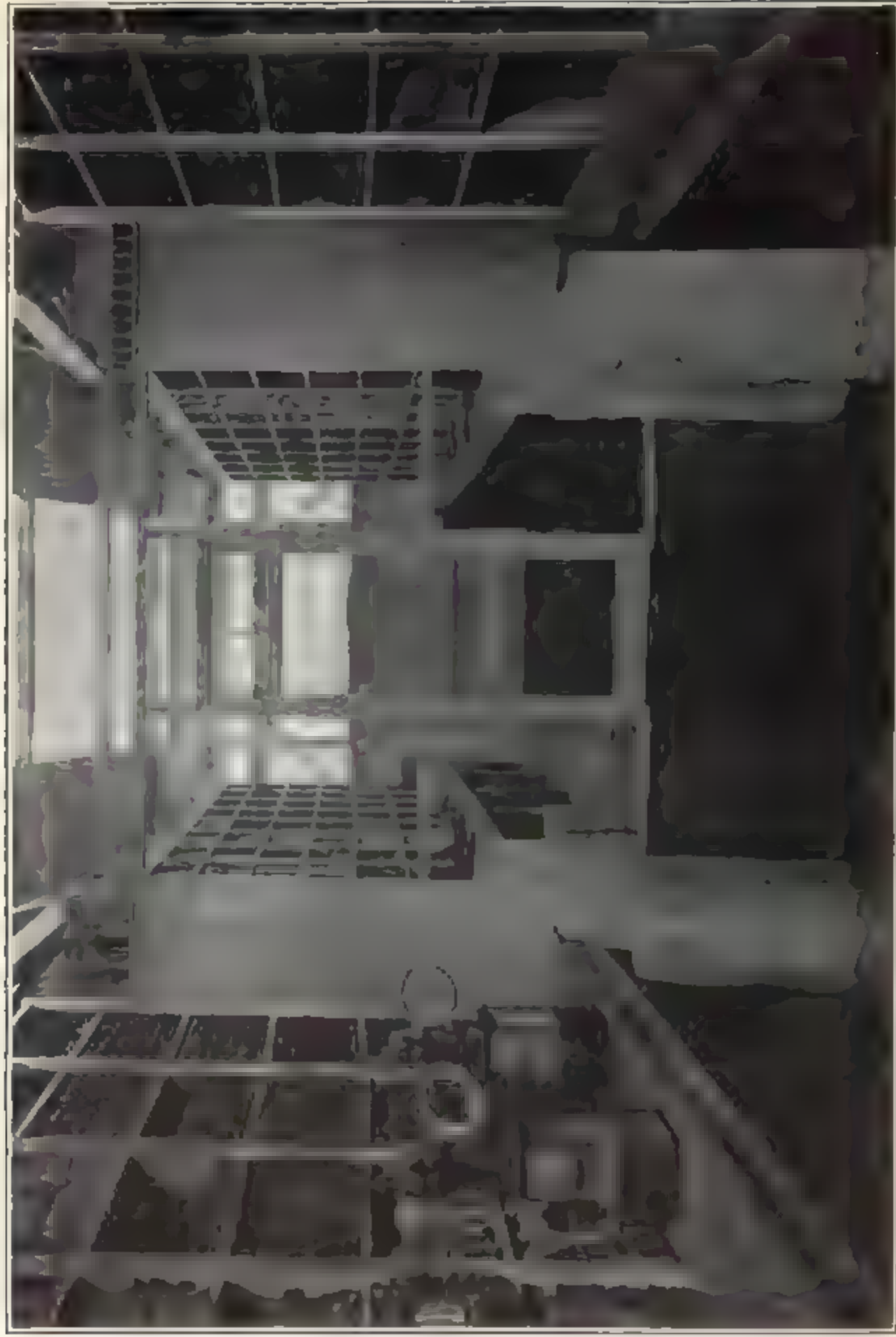


PLATE 132.



LOOKING THROUGH ONE OF THE FIRE WALLS, ON THE GROUND FLOOR, AT THE MOUNT HOPE STOREHOUSE AS REBUILT.





SECTION "A," MOUNT HOPE STOREHOUSE, SHOWING SHELF HARDWARE.



required by the mechanical department in their shops and foundry. The storekeeper at Empire has jurisdiction over the district between Bas Obispo and Paraiso (which includes the stores at Bas Obispo, Empire, and Culebra, the lumber yard at Culebra, the corrals at Culebra and Empire, and the powder magazines at Bas Obispo and Culebra). This is the most important store on the Isthmus—outside of Mount Hope store—as all maintenance-of-way material, train supplies, repairs and supplies for steam shovels, drills, locomotives, cars, etc., used on the Culebra division are furnished from Empire store. The Paraiso store furnishes all material and supplies for locomotives, steam shovels, etc., used at the south end of Culebra cut; also supplies for the mechanical division, which maintains shops at that point. Ancon store furnishes all material and supplies, forage, etc., required at the Ancon corrals and the minor supplies required by the other departments at Panama and Ancon. The La Boca store furnishes all material and supplies required by La Boca shops and for the floating equipment and for other departments at or in the vicinity of La Boca. The storekeeper at this point also has charge of the La Boca lumber yard.

The printing plant and stationery department is in the administration building, Panama, and handles all the stationery and printing required by the various departments on the Isthmus; also supplies for the engineering department, such as transits, levels, steel tapes, office supplies, etc., and also a large portion of the printing and stationery required by the Panama Railroad. Rubber stamps are also manufactured by this department. The plant consists of fourteen presses, which are operated by a gasoline engine, ruling machines, paper cutters, bindery, etc., which go to make up a complete printing establishment. This plant is kept running at full capacity at all times.

The division of material and supplies also has charge of all land transportation, which, at the present time, consists of about 600 horses and mules, with the necessary wagons, carts, carriages, ambulances, and other equipment. Corrals are located at Cristobal, Gatun, Tabernilla, Gorgona, Bas Obispo, Las Cascadas, Empire, Culebra, Paraiso, Corozal, Ancon, and La Boca. The corral staffs consist of one superintendent of transportation and veterinary surgeon, with headquarters at Cristobal, with jurisdiction over the large number of animals at Cristobal, Colon Hospital, and Gatun, and one assistant superintendent of transportation and veterinary surgeon at Ancon to take care of the business at that end, the two largest corrals being at Ancon and Cristobal. Each corral is under the immediate jurisdiction of a corral foreman. The superintendent of transportation and veterinary surgeon make weekly visits to all corrals on the Isthmus and oftener if necessary, so that the efficiency of the force and maximum amount of work from the animals and proper care of same is procured. We also have a system of daily reports from each of the corral foremen, which keeps the head of the division continually in touch with the business and conditions at each point. This not only applies to corrals but to storehouses.

The diversity of work found in the construction of the Panama Canal necessitates the purchase and use of an almost endless variety of equipment, material for repairs, and small supplies for maintenance.

It has been necessary to purchase rails and other track material, locomotives, cars, steam shovels, cranes, pile drivers, drills, unloaders,

earth spreaders, and other equipment for the physical work of excavation, and the disposition of the excavated material; lumber, roofing, hardware, plumbing, and all classes of building material for the construction, repair, and maintenance of gold and silver quarters, shops, storehouses, oil houses, hospitals, hotels, laborers' kitchens, penitentiaries, jails, post-offices, office buildings, clubhouses, cold storage and ice plants, laundry, bakeries, etc.; equipment, appliances, medicines, drugs, etc., for hospitals, dispensaries, and sick camps; machinery, tools, and supplies for shops, planing mills, foundries, round houses, etc.; equipment and supplies for the police and fire departments; furniture, dishes, and equipment for gold and silver quarters, hotels and laborers' kitchens; track material and tools for the construction, repair, and maintenance of tracks; animals, vehicles, forage, and corral supplies for local transportation; stone crushers, rollers, cement, sewer and water pipe, brick, and other materials for the use of the division of municipal engineering; dredges, tugs, lighters, barges, and other floating equipment for the marine work; and numberless other items used in connection with the operation, repair, and maintenance and equipment named, together with a supply of standard materials and supplies in stock at the various storehouses for the shops and for the use of all the different departments on the Isthmus.

These supplies consist of repair parts for locomotives, steam shovels, cars, drills, and other equipment and machinery; small tools for the shops; iron, steel, builders' hardware, plumbing material, furniture, marine supplies, track tools, paints and oils, foundry supplies, corral equipment and supplies, stationery and printed forms, and a great number of other articles that are constantly required by all branches of the work. We aim to limit our supply of standard material to approximately six months' requirements—this by reason of the length of time it requires, from date of requisition, to advertise, award, ship, and receive the material on the Isthmus—although many articles of standard supplies, such as oil, waste, lumber, roofing, track tools, nails, cement, etc., are "turned over" in from thirty to ninety days.

Every department on the Isthmus is dependent upon us for their supplies, and every effort is made to anticipate the wants of each division so that requisitions can be filled promptly and fully. We endeavor to carry at our substores the class of material and supplies needed by the various departments in that vicinity, and protect our stock by frequent purchases in the States, based either on estimates furnished us by the different divisions as to their requirements or from data obtained from our various storekeepers regarding their stock on hand and the consumption of material as shown by their stock records.

The material situation is canvassed continually with all departments with a view to keeping in touch with their requirements.

For convenience in placing stock requisitions storekeepers also keep a book record of stock; inventories are made of the principal items each month or oftener and supplies are ordered on basis of the consumption for certain standard articles from month to month. These stock books have columns showing the quantities on hand at the beginning of the month, the quantities ordered each month, and the quantities received during the month.

By reason of this record the storekeepers can keep a line on the consumption of various materials from month to month, and their stock orders are based upon the consumption as shown on their stock books.

The division of material and supplies as now organized is handling the immense amount of business required of it in an efficient and businesslike manner, and works in harmony with all other departments and in the interest of the Government in connection with the great work of constructing the Panama Canal.

The health conditions of the employees of this division during the past fiscal year have been exceptionally good. There have been no deaths among the white employees and very few cases of illness.

I have the honor to be, yours, very respectfully,

W. G. TUBBY,

Chief, Division of Material and Supplies.

Col. GEO. W. GOETHALS,

Chairman and Chief Engineer, Culebra, Canal Zone.

APPENDIX E.

REPORT ON THE GEOLOGY OF THE CANAL ZONE.

ISTHMIAN CANAL COMMISSION,
Washington Office, June 26, 1907.

SIR: I have the honor to transmit herewith my final report on the geology of the Canal Zone. A copy of the report has been sent to the honorable the Secretary of War.

Very respectfully,

ERNEST HOWE,
Geologist.

The CHIEF ENGINEER, ISTHMIAN CANAL COMMISSION,
Culebra, Canal Zone.

INTRODUCTION.

In the following description of the geology of that portion of the Isthmus of Panama traversed by the Panama Canal an effort has been made to confine the discussion to matters of general interest and to describe such features as have special bearing on the problem of canal construction. Many details and theories of interest only to specialists have been purposely omitted, since the objects of the survey were primarily practical ones and were intended to supply information in regard to the character of the sites selected for locks and dams, and to obtain some idea as to the natural resources of the country and especially in regard to building materials.

In the course of the survey data of considerable scientific value were obtained that, it is believed, will throw light on a number of obscure problems of Isthmian geology. This material will be published elsewhere.

The present report is in two parts. The first is devoted to a description of the various geological formations that have been recognized on the Isthmus, while in the second part such practical questions as the character of foundations, classification of materials to be excavated and the possibility of manufacturing Portland cement from local materials are discussed in detail.

PART I.

DESCRIPTIVE GEOLOGY.

TOPOGRAPHY.

In passing from the Atlantic to the Pacific, the canal line traverses three well-defined topographic divisions. The first is that of the lower valley of the Chagres, and includes the swampy lowlands that

extend from Limon Bay nearly to Bohio. This division ends near San Pablo, about 6 miles below the point where the Rio Obispo enters the Chagres. The second division is that of the summit region, and extends from San Pablo to Pedro Miguel, while the third lies between Pedro Miguel and La Boca, and, like the first, is generally low and swampy.

The Caribbean slope.—East and south of Limon Bay, a swamp, whose elevation is little above that of the sea, extends backward for 2 miles or so from the shore. Low hills, hardly continuous enough to be called a range, lie directly back of Colon and the bay: they are the Monkey Hills, near Colon, while to the southwest they are known as the Mindr Hills. Their summits are extremely uniform in height, rising about 50 feet above the level of the swamps. These hills have an important bearing on the physiographic development of the region, and are referred to later under the heading, "Development of the present topography."

Forming a crescent-shaped boundary between the littoral swamps and the basin of the Chagres Valley and its tributaries, the Gatuncillo and Trinidad, is a well-defined range of hills, over 100 feet in elevation, that extends from the coast east of Colon to a point some miles west of Limon Bay, the continuity of the hills being broken only where the Chagres River has cut a broad passage through them at Gatun. From this point southeast the valley, dotted with low conical or rounded hills which rise from swampy alluvial flats, gradually becomes narrower until, near San Pablo, the lowlands cease and the hilly portion of the Isthmus begins.

The Central region. The second topographic division includes that portion of the Chagres Valley that lies between San Pablo and Matachin, the valley of the Obispo to near its head at Culebra, and, on the Pacific Slope, the valley of the Rio Grande to Pedro Miguel, a total distance of about 16 miles. The region is one of rounded or conical hills 500 to 1,000 feet in elevation that are without systematic arrangement in chains or groups. From San Pablo to Obispo the valley is comparatively open, but at the latter point the Chagres is left by the line of the canal and the valley of the Obispo followed. In its lower part between Las Cascadas and Bas Obispo the valley is narrow and hemmed in by hills. Just south of Las Cascadas there is an open basin, which, between Empire and Culebra, has a width of more than a mile; it is surrounded by lofty hills and has a minimum elevation of about 200 feet. South of the continental divide at Culebra there is a rapid descent with a widening of the valley of the Rio Grande to Pedro Miguel, where the stream is joined by several tributaries.

The Pacific slope.—The expansion of the valley at Pedro Miguel marks the beginning of the third topographic division. With the development of flood plains in the lower valley of the Rio Grande swampy conditions comparable to those on the Atlantic exist, but to the northeast and southwest of the valley the hilly topography of the central portion continues quite to the sea, while several isolated hills rise from the floor of the valley to elevations of from 300 to 500 feet. At the point where the stream enters the Pacific at La Boca, the valley is hemmed in by Ancon and Sosa hills on the east and on the west by the southern extension of central uplands, so that it has the form of a broad open basin, with a narrow outlet to the Pacific.

It will be shown in discussing the geology of the region that there is a close relationship between the geology and the topography, and that most of the differences in the topography which are encountered in crossing from one side of the Isthmus to the other are to be attributed very largely to the character of the underlying formations.

GEOLOGY.

INTRODUCTION.

From surface outcrops, borings and exposures made by excavation for the canal and the Panama Railroad, it is possible to obtain a clear idea of the broader features of the geology of the Canal Zone. Most of the points concerning which there may be some uncertainty are of minor importance and have no direct bearing on the problems of canal construction.

Before taking up detailed descriptions, it will be well to consider briefly the different formations that have been recognized, and their relations to one another.

The central portion of the Isthmus along the canal line consists of rocks of igneous origin. They are the oldest rocks of the region and have been observed at the surface in the central area, between Mamei and Empire and northeast of the city of Panama; diamond drill borings have indicated their presence also at other points, and it is believed that they underlie at greater or less depth the whole territory included in the Canal Zone.

To the northwest younger rocks of sedimentary origin occur, resting on the older igneous mass, and gently inclined toward the Caribbean Sea, so that in passing from the interior toward Colon successively younger beds are encountered. Their well-defined stratification and the abundant fossil remains of marine organisms indicate that these rocks were formed by the deposition of gravel, sand, and mud on the sea bottom, or in tidal estuaries where the materials gradually hardened into rock. Nearly the same conditions prevail on the Pacific side, where, in addition to the older igneous and sedimentary rocks, younger igneous rocks occur.

Dikes and large cross-cutting masses of a basaltic nature have invaded all of the older sedimentary rocks; they occur in greatest abundance in the central and southern parts of the Zone and are believed to represent the last phase of active volcanism in the neighborhood.

DESCRIPTION OF FORMATIONS.

OBISPO FORMATION

From its very characteristic occurrence in the vicinity of Obispo, this name has been given to the formation about to be described that occupies a large part of the central region and consists of andesitic breccias and associated lava flows.

Description of the rock.—The term breccia is applied to rocks which are composed of angular fragments firmly held together by some cementing material. Breccias may be of different origins, but those under discussion are of the kind known as volcanic breccias, that is, they are composed of angular or subangular fragments of igneous

rocks of various sizes, from that of fine gravel to blocks 1 foot or more in diameter. In the case of a volcanic breccia the cement usually consists of finer material of the same composition as the included fragments. Breccias such as those that make up a large part of the Obispo formation are the result of volcanic eruptions of explosive violence, by which great quantities of volcanic 'ash,' lapilli, and large and small blocks of igneous rock are hurled from the throat of the volcano and deposited either on the surface of the adjoining land or laid down in sea or lake basins. In such eruptions the finer material thrown out has been thoroughly calcined by the heat of the volcano and subsequently triturated by the force of the explosion, so that it possesses the properties of a natural hydraulic cement and needs only a little moisture to set and bind the ejected material into a solid rock.

The Obispo breccias, which are believed to constitute a large part of the formation, are of variable texture, usually being composed of angular fragments an inch or more in diameter. No evidence was found that they were laid down or sorted by the action of running water. The fragments consist of andesite of a variety of textures and show slight differences in composition. The majority of the fragments appear to consist of pyroxene-andesite, although a fair percentage of hornblende-andesites are present. The color of the breccia on fresh exposures is a dark blue or green. The rock near the surface has been altered to a red clay.

At a few places, notably in the vicinity of Empire, lava flows of massive andesite were found associated with the breccias. The actual relation of the flows to the breccias is not clearly shown, but it is believed that they were contemporaneous and that quiet outpourings of lava alternated with the explosive eruptions that produced the breccias. The massive rock is of essentially the same composition as that composing many of the fragments in the breccias, but in most cases is too far decomposed to admit of exact determinations.

Occurrence of the Obispo formation. As was said in the introductory paragraph, it is believed that the Obispo formation underlies all of the Isthmian region, or at least so much as is included within the Canal Zone. It may be traced almost continuously from south of Empire to Mamei, while borings in the vicinity of San Pablo show that it is only a few feet below the surface at that locality. North of this point younger formations occur, and if the Obispo rocks are present they are deeply buried beneath the cover of later sediments. South of Empire the breccias disappear beneath the thick cover of the Culebra formation, to be described later.

Rocks of the same character occur in the hills northeast of Corozal and to the east of the city of Panama, in the vicinity of Las Sabanas. Although the relation of these rocks to the acid pyroclastics of the region is not clearly shown, it is believed that the andesitic breccias are older and that they are a part of the Obispo formation.

The thickness and east and west extension of this formation is absolutely unknown. Borings in the vicinity of Empire passed through 200 feet of the breccia and did not encounter any other kind of rock. Formations of similar character in the Rocky Mountain region of the United States have observed thicknesses of from 2,000 to 4,000 feet.

Judging from the extremely unconformable relations that exist between the Obispo formation and the younger rocks, it seems clear that following the eruption of the breccias the region was thoroughly dissected by the erosive action of streams. The interval between the close of the andesitic eruptions and the beginning of the next recorded epoch was of unknown extent, and the original surfaces of the Obispo rocks were completely obliterated before the next succeeding formation the Bohio was deposited.

BOHIO FORMATION

Probably the oldest sedimentary formation represented in the Zone is that which has its most characteristic outcrops in the vicinity of Bohio.

Character of the rock.—Near the railroad station is a cliff, from which building stone has been quarried and which rises 50 feet or so from the level of the flat on which the town is built. The rock here is of a very even texture and at first glance strongly suggests a fine-grained volcanic breccia. It is of a peculiar brownish color, unlike that of the Obispo breccia; the fragments are apparently angular and usually less than 1 inch in diameter. One of the most striking features of this rock, shown in deep borings as well as at surface outcrops, is its alteration; it mashes under a blow of the hammer, and yet has not the appearance of being greatly decomposed, except at or very near the surface. The alteration seems to have been to serpentine or some related mineral instead of kaolin, as is usually the case with the other rocks, especially those of the Obispo formation.

Across the river, at the old lock site south of Bohio and east of Peña Blanca, quite a different phase of this formation is exposed; it consists of alternating layers of sandstones and coarse conglomerates all clearly water transported and deposited. Many of the boulders are a foot or more in diameter; they are of andesites for the most part, but not a few are of a lighter colored porphyritic rock with abundant hornblende crystals. The finer layers and the cementing material are very like the rock occurring at the Bohio quarries. Crossbedding is common and fine material often occurs in lenses in the grits and conglomerates. The prevailing strike is N. 25 E., and the dip to the northwest at an angle of about 14 degrees.

The identity of these conglomerates and the more even-textured breccia-like rock is not at all evident in the field, but many borings made in the vicinity show a gradual transition southward from the even textured breccias of Bohio to the conglomeratic facies at Peña Blanca.

The boring made at kilometer 24 (hole 24-b) is of interest, since it shows carbonaceous sandstones in the middle part and fossils in the lower part of the core.

Further study of this formation to the southeast and by means of borings has shown that it is of variable character, in some places clearly sedimentary and water sorted, both fine grained and conglomeratic; in other places the appearance is more that of a volcanic breccia, possibly water laid but not water transported. The pyroclastic appearance may be a deceptive one and due to the alteration of the rock.

In general the formation may be described as a probable fluvatile deposit characterized by sudden changes and transitions, the com-

position of the materials being fairly uniform. It is not improbable that volcanic eruptions may have been taking place during the period in which the formation was deposited and the material forming the breccia-like portion attributed directly to such a source.

Age of the formation — The fossils previously referred to that were found in the core taken from hole 24-b occur at elevations of from 30 to 40 feet below sea level. They include, in addition to vegetable matter, certain fossils indicating probable Eocene age. At about 2 miles to the west at a locality known as Vamos Vamos, on the left bank of the French canal, are outcrops of a limy shale with large calcareous concretions resembling boulders in a conglomerate; both the shale and concretions contain numerous fossils which Dr. William H. Dall regards as of undoubted Eocene age. Outcrops of similar rock containing the same fossils occur about 6 miles to the northwest on the left bank of the canal in the vicinity of Gatun.

The rocks at Vamos Vamos and in the vicinity of Gatun are finer grained than those of the Bohio formation and consist of shales and fine sandstones.

The fossil evidence shows with certainty that the beds near Gatun and at Vamos Vamos and Bohio are of the same age, and it is believed that they are to be regarded strictly as part of one formation, the occurrence at Bohio representing a littoral facies, while those farther to the northwest were deposited in deeper water.

MARLS OF PEÑA BLANCA.

In the excavations made by the French between Bohio and Peña Blanca, and also at the base of a little hill at the west end of the village of Bohio, there are outcrops of a white calcareous sandstone or marl containing some volcanic material in the form of crystals of feldspar and fine specks of a ferromagnesian mineral. In places it is extremely rich in the remains of foraminifera, especially *Orbitoides fortisi*, and may seem to consist altogether of the shells of these minute organisms.

The points where these rocks are found lie between the occurrences of Bohio rock at Bohio and Vamos Vamos, but the true relations between these two formations are unknown since they have been found nowhere in contact. R. T. Hill states that he has found them in unconformable contact at the river's edge near Bohio, but this locality I have been unable to identify.

The foraminifera of the Peña Blanca rocks, and especially the species *Orbitoides fortisi*, are characteristic of the Lower Oligocene. From their position between two well-determined occurrences of Eocene rocks it is believed that they are clearly younger than the Bohio formation and rest upon these rocks unconformably.

GATUN FORMATION

Directly above a conglomerate that occurs near the railroad station at Gatun is a brownish, impure calcareous clay or argillaceous sandstone, apparently containing much débris of volcanic rocks and numerous fragments of shells. Many perfect fossils are to be found, but the extremely crumbling nature of the rock makes it almost impossible to obtain good specimens. Such as were collected have been determined

by Doctor Dall as of probable Oligocene age and newer than the foraminiferal beds of Peña Blanca, and the rocks are to be regarded as near the base of the succeeding Oligocene formations that occur at numerous places between Gatun and the bay, notably at the Mindi Hills and at the Monkey Hills.

The conglomerate under these sandstones contains many fossils that are the same as those of the Bohio and Vamos Vamos beds, but it is believed that the conglomerate represents the base of the Gatun formation and that the Eocene fossils present were derived from the older rocks and so do not indicate the true age of the conglomerate.

Outcrops are not numerous in the vicinity of Gatun, but the great number of borings that have been made in the neighborhood in exploring for lock sites supply much information in regard to the character of these younger beds, which for convenience may be referred to as the Gatun formation. They are appreciably different from the rocks of the Bohio formation, whether occurring at Bohio itself or in the more distant localities.

Soft sandstones of a dirty greenish-gray color, derived from igneous rocks with a calcareous and clayey cement, are the most abundant rocks of the Gatun formation. Associated with them are shales, impure marls, greensands, and, at certain horizons, fine white tuffs composed of pumice, probably of the composition of a rhyolite, concerning which more will be said in a later section. The rocks are all well consolidated, though in a few rare cases sandy layers are found which crumble on exposure to the air. These are the beds that have been referred to frequently as "indurated clays." The term is a misleading one, since true clays make up but a small part of the formation. Induration is a term applied to the process by which sandstones or argillaceous rocks are converted into quartzites or slates by heat or mineralized solutions accompanying the intrusion of igneous rocks. None of these conditions existed in the vicinity of Gatun. The rocks are of sedimentary origin and were deposited on the sea bottom at some distance from the shore in the form of sands and clays. Their subsequent hardening into rock is the result of simple cementation by calcareous solutions contained in the sea water and through pressure. Certain beds are harder than others, since the nature of their constituents favored more complete consolidation. The beds, however, are not to be regarded as unconsolidated. They are all "rock," though in some instances soft enough to be loosened with a pick.

These beds extend northward with little change in lithologic character to the Monkey Hills in the vicinity of Colon. Fossils collected in the more northerly localities indicate that the beds in this region are still younger than those at Gatun. No sharp breaks have been observed, however, and it is believed that practically continuous sedimentation took place from the time the Gatun beds were deposited until the close of later sedimentation.

CULEBRA FORMATION.

The rocks belonging to this formation have been exposed by excavation from Las Cascadas to Pedro Miguel along the line of the canal, the best exposures being in the vicinity of Culebra.

The formation consists of a series of soft shales, with sandy, conglomeratic, and calcareous layers abundant. Limestones, as at

Empire, Las Cascadas, and in the railroad cut between these two places, are also indicated at several points by borings. Of these the occurrences at Empire (Camacho) are undoubtedly the most massive, the others being present apparently as lenses in the shales and sandstones. Although some thick beds of very homogeneous pure clay shales occur, most of the formation is richly carbonaceous, and at a number of places in the cut lens-like seams of lignite have been found and remains of trees and plants are abundant.

The age of the Culebra formation can not be fixed with absolute certainty. Fossils collected at a number of points between Las Cascadas and Pedro Miguel were not sufficiently characteristic to determine the age of the beds, but at the lock site at Pedro Miguel collections were made at two points less than 100 yards apart that supply more definite information. The fossils from the more northerly point, 30 feet vertically above the other horizon, are regarded by Dall as representing the Oligocene, probably a reef deposit. The material from the lower and more southerly locality is pronounced Eocene by Dall. From the prevailing southerly dip of the beds in the region the fossils from the two localities were believed in the field to belong to the same horizon. The lack of continuous outcrops, however, makes it impossible to assert positively that this is so. The only fossils collected by Hill from the Culebra formation came from the Empire limestone. Only the foraminiferal portion seems to have been determined, and these are regarded by Bagge as probably Eocene. The fossiliferous beds near Pedro Miguel are undoubtedly at or very near the top of the formation, since the dip carries them below the surface a short distance to the south, and borings at kilometer 59, slightly to the north, show the usual Culebra formation extending to an unknown depth below. The Eocene and Oligocene ages of the beds at the two localities at Pedro Miguel seem certain. In any event there can be little doubt of the Eocene age of the Culebra formation as a whole and its probable correlation with the Bohio and Vamos Vamos beds. The occurrence of an Oligocene fauna directly above the characteristic Eocene at Pedro Miguel is comparable to the sudden change that takes place at Gatun from the Eocene of the Vamos Vamos beds to the Oligocene of the Gatun formation.

The thickness of the Culebra formation has been variously estimated at from 400 to 500 feet. A boring made at kilometer 55 of the canal (hole 31) extends 40 feet below sea level, starting at 167 feet above the sea; 207 feet of Culebra beds are here indicated, while possibly 175 feet might be added as representing the part already excavated at the cut, giving a thickness of nearly 400 feet, with the bottom not yet shown.

Practically continuous outcrops may be found for a distance of 7 miles along the line of the canal from the vicinity of Las Cascadas to Pedro Miguel, but it is only from kilometer 53 southward that the great thickness of the beds occurs. At kilometer 53 a diamond-drill boring passed through the andesite breccias of the Obispo formation all the way, no trace of the Culebra being found, although it does occur at higher elevations on both sides of the canal cut.

Southward the Culebra formation may be traced on the surface or by borings to Pedro Miguel. The last boring records are at kilometers 58 and 59. Good outcrops occur, as has been said, about a third of a mile southeast of the point where the railroad crosses the

canal line near Pedro Miguel; south of this point no outcrops were found, but there can be no doubt that the beds continue for some distance farther, the general dip being moderate, and to the east of south, complicated by local deformations. Borings at the sites for the La Boca and Sosa-Corozal dams have shown the presence of sandy shales at depths of 70 feet or more below mean tide. Lithologically they are the same as many that occur at different horizons in the Culebra formation.

At several points in the 7 miles of outcrop, sharp deformation, crumpling and local faulting have been observed in the Culebra beds; in general the formation has a moderate inclination to the south.

The presence of lignite and carbonaceous clays back of Frijoles and Tabernilla and the limestones on the upper Chagres suggest that an actual connection may exist between the Culebra beds and the Bohio formation, but it has not yet been observed.

UPPER LIMITS OF OLDER SEDIMENTS

No well-marked upper limit to any of these beds, the Culebra, Bohio, Vamos Vamos, etc., has been found. The *Orbitoides* beds would seem to be slightly younger than the Bohio formation, but the contact apparently is an unconformable one, so that nothing definite can be learned from this. The fossil evidence, according to Doctor Dall, indicates that the *Orbitoides* beds are slightly younger than the Vamos Vamos, while at Gatun the beds immediately overlying the conglomerate containing fossils of Vamos Vamos age are pronounced by Dall to be Oligocene and probably younger than the *Orbitoides* marls. Very similar conditions seem to exist on the Pacific side. As has been said, the Culebra formation was traced as far as Pedro Miguel; here the beds have a moderate but persistent dip southward, but exposures cease about at the point where the canal line crosses the Rio Grande. It is here that the two horizons occur from which Eocene and Oligocene fossils were collected. The next outcrops to the southeast are at Miraflores, and their situation strongly suggests that they are of rocks stratigraphically above the Culebra.

ACID TUFFS AND RELATED ROCKS.

The rocks that occur in a cliff south of the railroad station at Miraflores, and that are exposed at a number of points southward near Corozal and Panama, are well-bedded, fine-grained tuffs, light in color, ranging from nearly pure white to light creams, pinks, and grays. Their general appearance would seem to indicate that they are composed of rhyolitic or trachytic materials, while a microscopical examination has shown that a large part of the rock consists of pumice or minute fragments of volcanic glass. The layers are of variable thickness, from 1 to 5 or 6 feet, the thin layers being of finer material and fresher than the thick ones, but all are decomposed and usually soft.

Outcrops of the tuffs are exposed at low tide along the water front at the city of Panama and may be traced westward to a point about midway between Ancon and Sosa hills. The tuffs are well stratified and thin bedded, and their structure is well shown in many places, the dips being from 5° to 10° to the southeast near Panama, but in the direction of Sosa the strike swings around nearly 90° and the dips

are to the southwest. Associated with the tuffs at the most westerly exposures are flows of massive rhyolite and dikes of the same rock occur in the vicinity of Gabilan, cutting the tuffs. The direction of the dikes is in all cases toward the summit of Ancon Hill. The whole of Ancon Hill itself consists of massive rhyolite porphyry. Northwest of the hill is a swamp in which there are no outcrops, but directly north of the hill the same tuffs are to be seen at a number of points in the railroad cuttings, and although much altered their structure is fairly well preserved and the dips are at low angles to the north. The more distant exposures at Corozal and Miraflores have variable dips to the north or southeast.

Taking these facts into consideration, although the evidence is far from complete, they would seem to indicate that Ancon Hill marks the source of the tuffs, and that the rhyolite composing it represents the final phase of eruption and that lavas choked the vent. In other words, Ancon Hill is to be regarded as the throat of an old volcano, and the beds of tuff sloping away from it in all directions represent the fragmental material thrown out from the volcano in the early stages of its existence.

These tuffs are the ones that Hill has described as the Panama formation. He considered them of Cretaceous age, and the oldest rocks exposed on the Isthmus. He makes no mention of the fossil locality near Pedro Miguel. Bertrand reports that near Pedro Miguel and Corozal borings show the presence of the fossiliferous part of the Culebra beneath the acid tuffs. Unfortunately it has been impossible to find any boring records in this vicinity, but the field relations seem to justify the acceptance of Bertrand's statement.

Borings made at the site of La Boca dam, after passing through sandy shales that are believed to belong to the Culebra beds, showed at a number of points rhyolite porphyry like that of Ancon Hill and apparently in the form of dikes cutting the shales.

The relations of the Pacific side, therefore, seem to indicate that the acid tuffs and breccias are younger than the Culebra formation, but whether or not they follow it conformably it is impossible to say.

On the Caribbean side beds similar to those of Corozal and Miraflores occur at San Pablo and are well exposed at the point where the Panama Railroad crosses the Chagres. The lithologic identity of these beds with those on the Pacific slope can not be doubted, but their relation to the sedimentary rocks at Bohio and Vamos Vamos is not shown directly.

Borings at San Pablo show that in this vicinity the acid tuffs are underlain by the andesitic breccias of the Obispo formation, but the absence of the Bohio formation has little significance. A hint as to the actual age of these tuffs was found in examining the borings at Gatun. In holes 438 and 377 made near the lock site, at elevations slightly below sea level, soft white rhyolite pumice tuff is indicated in the core. It is in some cases of a dirty white color with crystals of hornblende and orthoclase abundant. In hole 438 the tuff, compact in some places and crumbling at others, is composed of very fine particles of volcanic glass or pumice. The purity of this material shows that it can not have been transported by water, and its sharp unaltered glassy character strongly suggests that it is the direct deposit of volcanic material of the finer sort often referred to as "ash," and that it fell after eruption into the sea at some distance

from the vent, later settling to the bottom. These tuffs are clearly interbedded with the sandstones of the Gatun formation of Oligocene age. Without further information on the subject these facts would seem to indicate eruptions of rhyolite or trachyte during the Gatun epoch. The character of the material and its texture suggests that it was deposited in water at some distance from its source. Just where the source was is unknown, but it is probable that the tuff deposits of the Pacific and Atlantic sides were derived from more than one center of eruption.

A rock related to the rhyolite porphyry of Ancon Hill composes the islands of Naos and Culebra in Panama Bay. It contains a relatively large amount of plagioclase feldspar, in addition to quartz and orthoclase, which occur abundantly in the groundmass. From field relations it is impossible to say whether the rock is part of a surface flow or an intrusive body, but the crystalline character of the groundmass indicates that it is probably an intrusive.

An intrusive sheet of similar rock has been exposed on both sides of the Culebra Cut directly north of Gold Hill. Whether or not sedimentation continued from the time the Oligocene beds at Gatun were deposited until the youngest rocks, the impure shales and marls that occur at Monkey Hill, is unknown, but it is believed that no break occurred. The Monkey Hill beds are considered by Dall to belong to the middle or upper Oligocene.

INTRUSIONS OF BASIC ROCKS.

Occurrence.—At some time later than that in which the rhyolite tuffs were deposited, eruptions or intrusions of basic rocks took place in the Isthmian region. These rocks are prominent from the Pacific to the Culebra district at least; their presence northward is more than probable. It is difficult, and in many cases absolutely impossible, to determine the form and nature of these masses of basalt or andesite. Wherever they have been exposed in the canal excavation or railroad cutting they appear clearly as intrusives. Their presence seems to be indicated in many of the hills flanking the canal line in the summit region, but except where fairly deep excavations have been made it is quite impossible to discover the nature of the rock composing the hills, or, even if this is known, to arrive at any satisfactory conclusion as to its form, whether intrusive or flow.

Borings in the vicinity of La Boca show that many of the large hills in the neighborhood are composed entirely of a pyroxene-andesite and that they appear to cut the acid tuffs or breccias. Hole No. 224 at the Sosa lock site passes through the andesite of Sosa Hill for 70 feet, and then enters a rhyolite porphyry similar to that of Ancon Hill. Aguadulce Hill is another example, being surrounded on three sides at least by the Obispo breccias, and borings very near to what must be the contact are in andesite throughout.

At least one deep boring near Gatun showed "basalt" at the bottom of the hole, but the form of the occurrence is of course unknown. From the undoubted intrusive nature of many of the occurrences of the basic rocks as shown in the summit region, it is believed that most of the known bodies are of this nature. The presence of flows is to be expected, but none as such has been identified. The intrusives in the Culebra Cut and in the region to the south seem to have invaded

the clays of the Culebra formation, while still more to the south in the La Boca region they cut the acid tuffs. How much younger they may be is not known, but it is probable that they marked the termination of active volcanism in the Zone at least, and were either contemporaneous with or immediately followed the close of Tertiary sedimentation.

At Porto Bello, some 18 miles east of Colon, on the Caribbean, rocks of essentially the same character occur at the edge of the sea.

Petrographic character. The majority of the rocks that have been described as "basic" are augite-or hypersthene augite-andesites. Some, especially in the vicinity of the Culebra cut, are more basic, and are to be regarded as basalts; in a few cases they were found to contain olivine. They are in most cases very fine textured, and, when fresh, nearly black.

DEVELOPMENT OF THE PRESENT TOPOGRAPHY.

The events that followed and resulted in the development of the present topographic features must be referred in part at least to the close of the Tertiary, since the next fossils observed are shells of Pleistocene age occurring in deposits laid down after more than one partial cycle of erosion.

The beginning of the period of basic intrusions probably marked the close of sedimentation in Tertiary time, and it is believed that these events took place in the Miocene.

Various epeirogenic movements and minor folding and faulting, that are recorded in the present topography and geology, took place at this time, and were undoubtedly closely related to the intrusions of basic igneous rocks and larger masses of granular rocks that marked the close of the Tertiary.

Long after the period of intrusion had ceased, a general upward movement of the land with respect to sea level continued until nearly all of the Tertiary sediments were raised above the surface of the oceans. A condition of equilibrium was eventually reached and a long period of erosion began, which resulted in the degradation of the land to such an extent that the rugged topography that is believed to have existed at the time of the maximum uplift was subdued and the region became one of low, rolling hills in the central portion, bordered on the Atlantic and Pacific sides by broad plains whose surfaces were only a few feet above sea level. Across these plains rivers, flowing from the interior, meandered sluggishly. Remnants of this old base-leveled surface may be seen to-day in the level summits of the Monkey Hills near Colon and, to a less marked degree, at a number of points on the Pacific side. At this time it is believed that the Chagres River entered the Caribbean Sea at the point now marked by Limon Bay.

Following this period, in which little or no erosion was taking place, and streams meandered on flood plains far back from their mouths, the land was again elevated for about 50 feet near the coast and probably to a greater extent in the interior. As a result of this uplift the activities of the streams were revived, and new valleys were cut in the surface of the peneplain. The erosion resulting from this uplift continued long enough to develop wide, open valleys and almost obliterated all traces of the old surface. It was at this time that a small stream, entering the sea near the present mouth of the Chagres,

by vigorous headward erosion cut through the low divide that separated it from the Chagres and diverted the lower waters of the larger stream to its own channel, through which they have since continued to flow.

Before the streams succeeded in reducing the land a second time to a condition of base level, a third uplift occurred by which the land was elevated over 300 feet above its earlier position. The streams at once intrenched themselves in their old channels and cut deep and narrow valleys, almost canyon-like in character, far below their former flood plains, but before open valleys could be formed the land began to sink gradually, and the streams, with their velocity and carrying power checked near their mouths, aggraded their channels. The general subsidence continued until the intermediate level, or terrace, near Colon was submerged 10 feet or more below the sea. The deep valleys of the large streams were filled with alluvium, and shallow lagoons or estuaries extended inland from the sea for a number of miles. The clays and silts that underlie the swamps near Colon were deposited at this time, and the shells contained in them indicate that the events took place in the Pleistocene. A slight upward movement of the land has raised these silts and clays a few feet above tide level. Since then, or perhaps during the last uplift, wave action has accomplished the removal of a large part of such materials that probably filled what is now Limon Bay.

Although the preceding description has confined itself to the lower Chagres Valley, precisely the same conditions exist on the Pacific side of the Isthmus. A terrace or bench comparable to the Monkey Hill level may be recognized at many points in the vicinity of Panama and La Boca and in the islands of the bay. The floor of the Rio Grande Valley, although less extensive than that of the lower Chagres, corresponds to the lower or Colon level and, as on the Caribbean side, soundings in Panama Bay suggest the seaward extension of this second level. Borings in the vicinity of La Boca have developed cross sections of the Rio Grande that correspond to those of the Chagres, and indicate an older and deeper channel now filled with sedimentary material.

On approaching the central portion, both from the Caribbean and the Pacific, the topographic features illustrating the erosional history of the Isthmus become less and less marked, until in the summit district all details are lost in the region of high, steep-sided hills that present unbroken slopes from top to bottom.

Relation of the geology to the topography.—The influence that the different rock formations have had on the development of the present topography is clearly shown at many places. In general, where the rocks have been soft and easily attacked by streams the country is relatively low and open, while the harder and more massive rocks underlie regions of bolder relief.

The lower Chagres Valley has been eroded for the most part in the comparatively soft Eocene and Oligocene sedimentary rocks. At Bohio the more resistant breccias of the Bohio formation appear, and their presence is marked by a hilly topography that extends to Buena Vista. From Buena Vista to San Pablo the valley of the Chagres is again wide, and the rocks are comparatively soft, rhyolite tuffs or, back of Frijoles and Tabernilla, carbonaceous clays that may be contemporaneous with the Gatun beds.

From San Pablo southward the Obispo breccias and later andesitic intrusives are the prevailing rocks; they are hard and massive, and the topography is correspondingly rugged.

The presence of the Culebra clays is marked by the open valley or basin of the upper Rio Obispo, and where eminences occur, as at Empire and Culebra, they are found to be due to intrusive masses of andesite or basalt.

On the Pacific slope the occurrence of basic intrusive rocks in the rhyolite tuffs is characteristically shown at Aguadulce and Sosa Hills that rise abruptly from the plain eroded by the Rio Grande in the softer rhyolite tuffs, or shales of the Culebra beds.

PART II.

APPLIED GEOLOGY.

The relation of the Isthmian geology to the varied problems of canal construction is, in all cases, intimate. One of the problems that is closely connected with the geology is that of the excavation of the cut in the central area. Actual work has advanced so far in this region, however, that geology can add little to the practical information acquired in the course of the excavation that has already been made. A less evident, but perhaps closer, relationship exists between the geology and the problems attendant upon the construction of the locks and dams, while the necessity of obtaining large quantities of building material near the points where locks and regulating works are to be constructed calls for a special study.

EXCAVATION.

In estimates for excavation, and in studies of foundations for masonry structures, materials are usually placed in one of three groups—earth, soft rock, and hard rock. This grouping is, of course, arbitrary, but from long practice the divisions have come to be fairly well defined. In this report the following distinctions will be recognized:

Earth includes soil, alluvium—such as clay, sand, and gravel—and clays of decomposition, in which all traces of the original structure of the rocks from which they were derived have been lost.

Soft rock is usually understood to mean material that is more or less consolidated but still soft enough to be handled with picks or steam shovels. A distinction should be made between such rocks as are naturally soft and those that have become soft as a result of decomposition. The rocks of all humid tropical regions are generally much altered near the surface, certain rocks being more readily decomposed than others. The basic igneous rocks, rich in the plagioclase feldspars and ferro-magnesian silicates are especially subject to this surface decay, and yield plastic red clays that grade downward to the firm unaltered rocks from which they were derived. The presence of this layer of clay of decomposition over nearly all of the Isthmian region makes it extremely difficult in many places to classify the materials. At the surface the clays mixed with vegetable remains are comparatively soft and loamy and would most naturally be regarded as earth. Below this layer of soil the red and yellow clays may extend downward for 50 feet or more, often grading imperceptibly into the hard undecomposed rock. These red and

yellow clays are frequently referred to as soft rock; a better term would be "decomposed rock," reserving the term "soft rock" for the more or less consolidated rocks of fragmental character, whether of sedimentary or volcanic origin, that have not necessarily undergone decomposition. The line between the red or yellow clays, grouped as earth, and the decomposed rock, is necessarily an indefinite one.

Hard rock implies that the material is too tough and hard for picks or steam shovels to make any impression on it, and that blasting is in all cases necessary.

In the following table the rocks belonging to the different formations that have been described in the first part of this report are grouped according to this classification:

Classification of materials.

Kind of material	Character.	Formations represented.
Earth	Soil, alluvial clay, sand, and gravel, residual plastic clays resulting from the decomposition of rock in place.	Pleistocene and recent stream deposits, soil, and "red clay."
Soft rock	Soft or weakly consolidated marls, shales, sandstones, conglomerates, rhyolite tuff.	Parts of Bohio, Culebra and Gatun formations, acid tuffs of San Pablo and Corozal.
Hard rock.	Breccias, tuffs, and massive igneous rock, sandstones, conglomerates, limestones.	Obispo formation, acid tuffs (fresh) of Miraflores, Corozal, and San Pablo; rhyolite of Ancon Hill, intrusive andesites and lavas, certain horizons of Bohio and Gatun formations, limestones of Culebra formation.
Decomposed rock	Red and yellow gritty clays containing residual fragments or rounded masses of the unaltered rocks from which they were derived.	Overlie most of the soft rocks of the region to depths of from 5 to 50 feet. Basic igneous rocks more subject to decomposition than acid rocks, andesite breccias more profoundly altered than massive rocks of the same composition, sediments composed of the detritus of igneous rocks.

Information at hand from recent exposures and borings in the central region supplies very definite knowledge as to the nature of the materials to be encountered in excavating the prism between Bas Obispo and Pedro Miguel, and the description of the character of these rocks given in the first part of this report may be summarized here.

It will be seen from the geological profile (Plate 147) that from Obispo to the vicinity of Empire the excavation will be entirely in the rocks of the Obispo formation. The layer of superficial red clay and decomposed rock has already been passed, and the rest of the work will be in hard rock consisting of andesitic breccias with possibly an occasional flow of massive andesite. These rocks will become harder and firmer with depth.

From near Empire southward the cutting will be in the Culebra formation. It has been impossible to discover the character of the contact between the Culebra beds and the andesite breccias of the Obispo formation. The sudden change from one to the other and the great thickness of the Culebra beds that is indicated a short distance south of the point where the last exposures of the Obispo rocks occur suggest that the rocks of the two formations may be separated from one another by a fault, but the fact that calcareous beds belonging to the upper part of the Culebra formation are found at many points, as far north as Las Cascadas resting on the Obispo rocks indicates that unconformable relations are more apt to exist between the two formations than that they are separated from one another by a struc-

tural break. Several small faults do occur in the Culebra beds between Culebra and Empire, and cross the canal in an east and west direction; they will have no effect on excavation nor upon the stability of the slopes; with increased depth there will be little change in the hardness of the Culebra beds; they are to be classified as soft rock and should be easily handled by steam shovels to the desired depth if broken up by blasting.

The physical character of the Culebra beds, consisting as they do of alternating layers of sandstone and shale, is peculiarly favorable to landslides. Structurally, however, the strata are so nearly horizontal, or have such low southerly dips north of Gold Hill, that movements involving large masses of rock are improbable, while slopes of suitable angles will do away with the danger of minor slips.

Gold Hill is bounded on the north and south by faults, the mass of the hill having sunk with respect to the rocks on the other sides of the faults. During the process of faulting the strata were twisted to the eastward, and now have steep dips in that direction. This structure is also complicated by large masses of intrusive basalt which were included in the Culebra beds prior to the faulting. The induration resulting from these intrusions has been so extensive that all the rocks in Gold Hill are now very hard and firm, and with the sedimentary beds dipping into the hill the conditions are such that landslides are most unlikely to occur.

In Contractors Hill a heavy breccia member of the Culebra beds dips in the direction of the cut. It is believed that the soft Culebra beds will be encountered below the breccias. If these beds are found to have strong northeasterly dips—that is, if they are inclined in the direction of the cut, as the surface indications suggest—it will be necessary to make comparatively low slopes on the southwest side of the canal at Contractors Hill in order to avoid any possibility of landslides. This is the only point along the canal where such movements are at all possible. In my opinion the danger is not serious, but ordinary prudence requires that, if the soft Culebra beds are found beneath the breccias to dip at angles of more than 15° in the direction of the cut, the angle of slope be so reduced as to do away with all danger of slipping.

Between Gold Hill and Cucuracha, on the northeast side of the cut, landslides have taken place frequently in the rainy season. The materials involved in these slides are purely superficial: in some cases French spoil banks have slipped. The cause in all cases seems to be the saturation of the unconsolidated surface material and its movement on layers of slippery clays either in the Culebra beds or residual clays upon which spoil was dumped. The basin south and east of Gold Hill collects large quantities of water during the rainy season, and this escapes through no well-defined drainage, but in springs along the edge of the cut. In some cases surface soils or even the rock of the Culebra formation may take place in these landslips. They are not serious, however, and although they may continue in a minor degree for a number of years, the removal of the material before it reaches the edge of the cut and the gradual reduction of the slopes back of the cut will stop this trouble. The French attempted an elaborate system of drainage to overcome the difficulty, but this has been proven entirely inadequate, and it is improbable that any system of this sort would be practical or economical.

GEOLOGY OF THE DAM AND LOCK SITE.

GATUN.

Introduction.—At Gatun the sides of the broad lower valley of the Chagres converge and the stream passes through a gap in the Sierra Quebrancha a little over 1 mile wide. These hills trend northeast from Gatun in a well-defined chain. On the southwest side of the river the range widens and extends south and west as a hilly region between the Trinidad drainage and the sea, with a divide near the Trinidad River. From Bohio northwest the whole region is one of young sedimentary rocks and the wide and open character of the Chagres, Trinidad, and Gatuncillo valleys is due to the ease with which these rocks have been eroded. Younger and slightly harder rocks have been preserved in the hills bordering the lower part of the valley, and it is of these that the Sierra Quebrancha is composed. The rocks consist almost entirely of blue or gray argillaceous sandstones, well bedded and inclined at low angles toward the Caribbean. Excavation for the locks will be in these rocks throughout.

It was shown in Part I of this report that the Chagres, as a result of a sudden uplift of the land, cut a deep and narrow gorge in its broad valley, and following the subsidence of the land this gorge was filled with alluvial materials. It is on this alluvium that a greater part of the dam will rest.

Geology of the lock site.—The site selected for the locks at Gatun is northeast of the old village about one-quarter of a mile from the river in the southern extension of the Quebrancha Hills. The temporary spillway will be cut through the low hill that rises from the floor of the valley between the French canal and the west diversion. The rocks which for convenience may be referred to as the Gatun formation, are largely argillaceous sandstones. The sand of which they are composed was derived from the older igneous rocks of the region, which, at the time the Gatun beds were being deposited, were undergoing rapid disintegration and erosion. The débris resulting from the breaking down of these rocks was transported by stream to the sea and deposited, layer upon layer, until 200 feet or more had accumulated. Considerable clay was mixed with the sand, and this, together with lime derived from sea water, acted as a cement and bound the grains of sand together, forming a massive rock. The old rocks from which the sands were derived were almost if not entirely destitute of quartz, and the sandstones, lacking this mineral, are more subject to decomposition than rocks consisting principally of quartz sand. Where protected, however, the Gatun sandstones are firm and hard. The decomposition of these rocks results in the formation of red or yellow clay. The depth to which such decomposition extends is variable, but at Gatun fresh rock occurs within 15 feet of the surface of the ground and often less.

The texture of the rocks of the Gatun formation is quite uniform. Most of the rock is a fine grained argillaceous sandstone; at one horizon coarse grits or conglomerates occur, but they amount to a very small part of the formation as a whole. When fresh the rock is of a bluish-gray color, certain parts rich in fossils are lighter than others and more finely cemented.

Excavation for the locks will be almost entirely in the fine-grained argillaceous sandstone except at the lowest point to be reached at the extreme southern end where conglomerate occurs beneath the sandstones. The rocks as a whole are well consolidated and make excellent cores with the diamond drill. When taken out and exposed on the surface they remain firm and hard; in rare instances they have been found to crumble and break down into a sandy clay. The rocks are well compacted and capable of supporting heavy loads when confined, but being poorly cemented are unable to withstand erosion, and should be fully protected where such action is anticipated.

On account of the very considerable amount of clay present in all of the rocks, it is believed that they will prove to be almost entirely impervious to water. An exception will be found in the conglomerate referred to. Although this rock contains considerable clay it has been found where exposed at about sea level in test pit No. 1 to be water bearing. On April 1, 1907, a pump discharging about 12 gallons per minute was just able to hold the water at an approximately constant level in the pit. The surface of the conglomerate exposed in the sides and bottom of the pit was about 240 square feet. Whenever this conglomerate is encountered it may be expected to be water bearing at all times. In the test pit this rock stands in vertical walls without timbering, and as long as confined will support heavy loads.

Compression tests. -In order to obtain some idea of the compression that might take place under loads equal to or greater than those due to the weight of the lock walls, a freshly exposed surface of the argillaceous sandstone near test pit No. 1 was leveled and smoothed by means of a file. Upon a square foot of this surface 100 steel rails, representing a weight of 77,350 pounds, were balanced upon the side of a short I-beam, to the under side of which a casting, having a smooth surface one square foot in area, was firmly bolted. After a load of 37,128 pounds had been applied, a settling of 0.011 of a foot was recorded, measurement being made by means of a Y-level with reference to a previously determined bench. From this point on, until forty-eight hours after the full load had been applied, no further compression was noted. It is probable that the settling at 37,128 pounds was due to the pressing out of small inequalities on the prepared surface and that no measurable compression of the rock mass took place. The load applied to the square foot was equal to 537 pounds to the square inch, more than double the greatest pressure likely to be brought to bear upon the sandstones by the lock walls.

Further tests were made upon small pieces of rock taken from different test pits. None of these pieces was larger than one-eighth of a cubic foot. They were embedded in sand and the pressure applied to smooth surfaces one half square inch in area. Seven tests were made upon pieces of conglomerate taken from the bottom of test pit No. 1. Some of this material had been exposed on the dump for twenty days. The samples failed at pressures of from 250 to 1,625 pounds per square inch, the mean of all the tests was 867 pounds to the square inch. Nine tests were made of the argillaceous sandstone taken from different test pits at the lock site and the site for the temporary spillway. Some of this material was taken from the walls of the test pits, other pieces had been lying on the dumps for a number of days. The samples failed at from 830 to 2,800 pounds per square inch. Two samples, both of which had been exposed on the dump for several days, showed no signs of failing when under pressures of

8,000 pounds to the square inch. Considering these as having failed at 8,000 pounds, the mean crushing load for the nine tests was 2,572 pounds per square inch.

Geology of the dam site.—In order to understand the conditions that exist beneath the surface of the ground upon which the earth dam is to be built, it is necessary to review briefly the late geological history of the region.

At some time after the Gatun beds had been deposited, the central and southern portions of the present Isthmus were subjected to volcanic disturbances and the whole region underwent considerable deformation, concomitant elevation, and probably minor faulting. The geology of the central portion of the Isthmus indicates that a vast amount of erosion took place following the elevation of the land and that the sedimentary and later volcanic rocks now exposed represent but a very small part of the beds that covered the region at the close of the Oligocene. It was during the first period of erosion that the surface now preserved in the level tops of the Monkey Hills near Colon was developed, and which at that time represented a low, nearly level plain, or "peneplain," as it is often called, that bordered the Caribbean. A second uplift followed the period in which the Monkey Hill peneplain was developed, and seems to have been a general one throughout the whole isthmic region. The erosion that followed this second uplift thoroughly dissected the old nearly level topography and developed a second, though less perfect, terrace, best shown near Colon. This is essentially the level of the swamps. This terrace, whose surface is broken in places by remnants of the Monkey Hill level, and which may be called the Colon level, extends considerably beyond the present coast line, as shown by soundings in Limon Bay. When the erosion resulting from this second uplift had progressed long enough to have developed wide, open valleys, in which the streams meandered, a third uplift occurred. The earlier, as shown by the difference in level between the tops of the Monkey Hills and the surface of the swamps, was a little over 50 feet. The third uplift was more sudden and elevated the land more than 300 feet. Evidence of this third epeirogenic uplift has been found repeatedly in exploring sites for dams across the Chagres Valley by means of borings. As a result of this uplift the streams entrenched themselves in deep canyons in the second level. When the Chagres had succeeded in cutting something more than 300 feet below this level, the land began to sink slowly and the gorges were gradually filled with gravels, sand, silt, and clay. At different horizons in these alluvial deposits are shells and trunks and branches of trees that indicate a gradual rather than a sudden subsidence.

It is believed that this sinking continued until a large part of the Colon level, now represented by the swamps, was submerged and covered by sea water, during which time the marine shells and fine river silts now exposed in the banks of the French canal and diversions were deposited.

The final event in the isthmic history was a slight elevation of the whole region that raised these deposits a few feet above tide level. It is probable that since this elevation wave action has accomplished the removal of a part of this weakly consolidated material, resulting in the formation of Limon Bay. The present bottom of the bay represents the still submerged Colon level, plus such muds and coral

reefs as may have accumulated in recent times; in the same way the swamp level near Colon is to be regarded as at a slightly greater elevation than the Colon terrace, being buried beneath recent marine deposits. From the evidence of marine shells contained in the clays and sands that fill the old gorge of the Chagres it is known that the events described took place in Pleistocene time.

There is to-day at the surface no indication of the existence of the Pleistocene valley, and all knowledge concerning it has been obtained from lines of borings made across the valley at Gatun, Bohio, Buena Vista, and San Pablo.

Character of the material filling the Pleistocene valley.--During periods of maximum uplift when streams are flowing in canyons like those of the Chagres, the rivers are heavily charged with detritus. All of the finer part of this material is swept down to the sea, the coarsest is deposited along the upper portions of the streams, but gravels and small boulders may fill the stream beds to the mouths of the rivers. If subsidence takes place before the period of canyon cutting has ceased, as in the case of the Chagres again, the velocity of streams is checked and they are capable of carrying fine material only, which is deposited far back from the mouths. In other words, one should expect to find at the bottom of such a gorge as the Chagres at Gatun a comparatively thin deposit of coarse gravel, sand, and a few boulders, while the greater part of the alluvium should be of the finest clay and silt with a certain amount of fine gravel and sand mixed with it. Such, in fact, is the character of the alluvium filling the gorge of the Chagres as shown by numerous borings made at Gatun. The boring records indicate considerable sand and gravel at points comparatively near the present surface; it is unlikely, however, that any sand or gravel, unmixed with clay, occurs in the deposits except at or very near the bottom. The reason for the boring records specifying "sand and gravel" as they do, is that when samples are taken from time to time during the process of sinking the hole, only the coarsest material is collected, the finer clay being held in suspension and carried off with the water flowing from the hole. In certain of the holes temporary flows of water were encountered, but after a few hours the flow invariably ceased. Such flows are believed to occur, when in the course of making a boring the casing is introduced into a lenticular deposit of sand or water-bearing gravel under pressure from the overlying beds. The sands being surrounded by much less pervious material are in the nature of reservoirs in which water is stored under pressure, and when this pressure is released at the point where the casing enters the sands, water may rise to the surface, if under sufficient pressure, and flow from the top of the casing until the pressures are readjusted. Far from indicating porous materials underlying the site for the dam, the occurrence of such flows of water only proves the extremely impervious character of the materials lying between the surface and the water-bearing beds.

As a foundation for an earth dam, the geological facts show that the alluvium filling the Pleistocene valley of the Chagres at Gatun will be entirely satisfactory.

The rock in which excavation must be made for the locks is firm and hard, and only slightly permeable to water; it will stand in vertical walls without timbering and will support loads many times greater than those to which it will be subjected.

TRINIDAD SPILLWAYS.

Spillway sites 1 and 2 in the Trinidad drainage are at low divides between the Trinidad and streams flowing into the Caribbean. The rocks at these two points are essentially the same as those occurring at Gatun. They are found in a fresh condition a short distance below the surface and have about the same hardness as the Gatun rock.

At spillway No. 3 the borings failed to discover fresh rock at the depth required for foundation, the material being a clay of decomposition derived from rocks probably the same as those at the other two spillways.

LOCK SITE AT PEDRO MIGUEL.

The rocks of the lock site at Pedro Miguel are similar to those of the Gatun formation; they are geologically younger, however, and belong to the same series of beds as the sedimentary rocks of the Culebra cut. Although the Culebra beds are variable in texture, those in which excavations for the Pedro Miguel locks will be made are remarkably uniform. They consist of well bedded sandy shales containing plant remains in a few places, and at some horizons lenticular masses of concretionary limestone are common. The physical properties of the rocks differ but little from those of the rocks at Gatun. Being more argillaceous the shales are naturally less permeable to water, and experience in sinking test pits showed that they were very tough and required more blasting than did the Gatun rocks under similar conditions. This greater toughness is to be attributed to the argillaceous nature of the rock; for the same reason their compressive strength is probably slightly less than that of the argillaceous sandstone of Gatun.

In the vicinity of Pedro Miguel the Culebra beds have a prevailing dip of 5° to 10° to the southeast, varied by sharp local folding; moderate fracturing has accompanied the folding, and slickensides are shown at many points where exposures have been made by recent excavation.

Dike. At the point where it is proposed to construct the lower gates a dike of augite-andesite or "trap" crosses the lock site in a direction slightly east of north. It has a width of about 30 feet where exposed on the southwest side of the cut, and its contacts with the shales are clean and sharp. On the northeast side of the cut the dike turns to the north and the contact is more irregular, small apophyses having been thrown off into the shales. The Culebra beds, which are here sharply flexed and considerably fractured, owe their deformation to some extent to the intrusion of the dike; the dike itself, however, is also fractured, and slickensided surfaces within its mass as well as in the shales indicate that movement has taken place subsequent to intrusion, accompanied, it is believed, by minor faulting along the west side of the dike.

These structural features have a direct bearing on the character of the foundations. The dike, on account of its fractured condition, which cracks have been shown to exist below the lowest points to be reached in excavating for foundations, will be permeable to water. The shales also have been made more or less pervious as a result of their deformation and consequent fracturing. On account of this fracturing local seepage of surface water is to be anticipated, but the

character of the Culebra beds northwestward is such that no flow of water is likely to occur through them even when the canal in the summit region is filled with water. Although the general dip of the beds is to the south, borings have shown the rocks to be the clay shales in large part, and as such not water bearing. Furthermore, several intrusive bodies of andesite or basalt cross the canal line between Culebra summit and Pedro Miguel, which will effectually check any flow of underground waters.

The difference in hardness between the trap rock of the dike and the much softer shales of the Culebra beds must be taken into account in planning the lock walls. The possibility of even very slight differential movement in the zone of fracturing and dislocation in the dike and shales adjacent to it should also be considered. By constructing the lock walls in sections, damage which might be done to monolithic walls as a result of such movements or from the unequal settling of foundations of different hardness will doubtless be obviated.

SOSA LOCK SITE.

The foundations for the Sosa locks will be in the same augite-andesite of which the mass of Sosa Hill is composed, and excavation will be in this rock throughout. This andesite or "trap," although traversed by a complicated system of joint planes is, whenever it has been observed, extremely massive. It has not been shattered, as has the dike at Pedro Miguel, and therefore little or no seepage is to be anticipated. As shown by the borings the elevation of the surface of hard rock is variable. A layer of decomposed rock overlies the fresh rock, and in the region of the mud flats this is covered by alluvial clays and sands. In all cases fresh rock will be found for the lock walls to rest upon.

DAMS.

La Boca Dam.—The ground upon which the La Boca Dam is to be built consists entirely of alluvium resting upon sandy shales of the Culebra formation in the middle of the valley. On both sides the alluvium rests on massive igneous rocks. The borings have developed an old channel below the present flood plain of the Rio Grande similar in character to that of the Chagres at Gatun, but they have shown that, at the point where the dam is to cross, the maximum depth is only about 70 feet below mean tide. The alluvial material consists largely of clay with sand and fine gravel mixed with it at different elevations. The material will be impervious.

Sosa-Corozal Dam.—Material of essentially the same character as that at La Boca underlies the site of the Sosa-Corozal Dam, but is of less thickness. The rocks that underlie the alluvium at depths of from 30 to 60 feet below mean tide are the sandy shales of the Culebra formation. Rhyolite tuffs are exposed in the hills at the northern end of the dam site.

Mechanical analyses of samples of alluvial materials collected at the sites of both the Sosa-Corozal and La Boca dams and from the sand bars in the bay beyond La Boca are given below. They were made at the request of the consulting engineers, Messrs. Noble, Stearns, and Freeman, in order to determine the permeability of these materials and their availability for use in constructing the dams.

Mechanical analyses of sand and mud from La Boca, Canal Zone.

(Made at the laboratory of the Bureau of Soils.)

	Number of sample.					
	2.	3.	4.	5.	6.	7.
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Organic matter.	0.8	1.8	0.8	7.5	5.8	2.1
Fine gravel, 2 to 1 mm.	7.1	1.1	7.8	3.1	2.8	18.9
Coarse sand, 1 to 0.5 mm.	14.9	8	39.9	7	3.3	21.2
Medium sand, 0.5 to 0.25 mm.	13.2	6	20.8	9	2.5	12.7
Fine sand, 0.25 to 0.1 mm.	42.2	2.7	11.0	6.2	23.4	15.7
Very fine sand, 0.1 to 0.05 mm.	8	2.6	4	3.4	7.1	2.2
Silt, 0.05 to 0.005 mm.	1.4	43.1	4.7	31.4	23.9	2.6
Clay, 0.005 to 0 mm.	3.0	40.2	2.3	54.4	34.6	12.8

No. 2. Coarse sand, 18 inches below surface, sand bar La Boca.

No. 3. Alluvial clay from dredge, one-fourth mile south of dock, La Boca.

No. 4. Sand from river bank, near north end of boom-Corral dam site.

No. 5. Mud from surface of mud flat opposite ship's ways, La Boca (near oil station).

No. 6. Mud from dredge, one-half mile south of dock, La Boca.

No. 7. Dry sample, hole No. 14, La Boca Dam, elevation 185, 20 feet below surface.

La Boca spillway.—The site selected for the permanent spillway at La Boca is situated about $1\frac{1}{2}$ miles west of the Rio Grande. The rocks at this point are firm, hard rhyolite breccias. Fresh rock occurs at or very near the surface.

MATERIALS AVAILABLE FOR PURPOSES OF CONSTRUCTION.

Since concrete will be used almost exclusively in all construction on the Isthmus, especially in the locks and regulating works, particular attention was paid in the field to the occurrence and quality of rocks suitable for crushing, sand, and raw cement materials.

Rock for concrete.—Although the majority of the rocks on the Isthmus are much decomposed near the surface, fresh material occurs at a number of places suitable for concrete or other purposes where crushed stone is required.

Practically all the rocks available for this purpose are the basic andesites or basalts, commonly referred to as "trap," that occur in the central and southern portions of the Isthmus. There are extensive outcrops at Sosa and Paraiso near the sites for the locks at the Pacific end of the canal. The rock at the proposed permanent spillway at La Boca is a hard rhyolite breccia and will be entirely satisfactory for crushing. The andesite breccias at Bas Obispo, which are being crushed and used for ballast on the Panama Railroad are excellent for that purpose, but not altogether desirable for use in concrete on account of their partial alteration.

No good rock occurs nearer the Atlantic side than San Pablo. This is a hard rhyolite tuff or breccia, but much better material is found at Porto Bello, 18 miles east of Colon, and the San Pablo rock would not be advised for use in the locks at Gatun. The Porto Bello rock is a massive andesite, and occurs in hills that rise directly from the water's edge in the harbor. The rock is well suited for use in concrete or for ballasting; its specific gravity is about 2.70.

On account of the extensive jointing of the hard rocks of the Isthmus, they can not be used for dimension stone. The rhyolitic rock south of San Pablo, and the breccias near the railroad station at Bohio have both been dressed and used in masonry structures of minor importance, but on account of their alteration they are

unreliable for use as dimension stone at points where exposed to wear or subjected to considerable pressure.

As soft rock alone occurs at the Trinidad spillway sites, crushed stone from Porto Bello will have to be used at whichever site is selected.

Sand.—No sand suitable for use in mortar or concrete has been found near the points where such material will be required. Sand of a fair quality occurs at a number of places in the Chagres River between Gamboa and Bohio. This sand could be used, if necessary, but the bars are completely covered during the rainy season, and the amount of sand at any one place is uncertain on account of variations in texture. Possibly 8 per cent of earthy or clayey matter is present in this sand, but not in sufficient quantities to be harmful.

A very high grade of sand containing over 80 per cent sharp, glassy quartz occurs on the beach at Chorrera, 18 miles west of La Boca. The sand is only of moderate coarseness, the diameter of the grains ranging from 0.25 to 0.75 mm. It is believed to be present in ample quantity. On the Atlantic side large deposits of sand derived from basic igneous rocks and containing but little quartz have been found just east of the harbor of Porto Bello. Although not of as high grade as the Chorrera sand, this material will be, it is believed, entirely satisfactory for use with the concrete at Gatun.

CEMENT MATERIALS.

In July and August, 1906, at the time of my first visit to the Isthmus, I was directed by the chief engineer to make a careful search for raw materials suitable for use in the manufacture of a high grade of Portland cement. Some months before samples of a supposed cement rock had been sent to the laboratory of the Geological Survey by the Commission for analysis, but the material proved to be of no value.

The limestones that occur sparingly in the Zone in the vicinity of Empire are variable in composition and limited in extent, while those exposed in the canyon of the Chagres River above Alhajuela, even if sufficiently pure, are too remote to be used economically.

Clay is one of the commonest substances in the whole Isthmian region, but its physical condition is extremely variable, notwithstanding the fact that its chemical composition is very uniform. Certain of the shales occurring in the various sedimentary formations in the vicinity of Culebra, and also on the Atlantic coast, might be used, but the difficulty of obtaining them in large quantities and of uniform quality and at points near the coral rock are serious objections.

After some study of the different kinds of argillaceous and calcareous rocks or deposits on the Isthmus, considering both their chemical and physical composition and accessibility, three classes of materials were decided upon as probably suitable for use. For the calcareous element, coral from the reefs bordering the whole Caribbean coast and occurring in great abundance in the immediate vicinity of Colon was decided upon.

The recent clays and silts brought down by the Chagres River and deposited near its mouth or in the French canal emptying into Limon Bay are extremely uniform both in texture and in chemical

composition. It was feared, however, at the time samples were collected, that the percentage of silica contained in the clays might be too low, so that samples were also taken of the pumiceous rhyolite tuffs occurring at the western end of the Panama Railroad bridge near San Pablo.

A sample of the coral rock from Limon Bay, three samples of mud taken from different points in the French canal between the dry dock at Mount Hope and the mouth of the Rio Mindi, and also a sample of the rhyolite tuffs from San Pablo were analyzed in the chemical laboratory of the United States Geological Survey. The results of these analyses are given below:

Partial analyses of cement materials.

[Made at the laboratory of the U. S. Geological Survey.]

	I.	II.	III.	IV.	V.	VI.
SiO ₂	39.41	49.31	49.49	46.00	58.00	41.29
Al ₂ O ₃ + (TiO ₂ , P ₂ O ₅).....	20.31	16.95	18.11	28.84	14.50	10
Fe ₂ O ₃ (total iron).....	9.40	10.55	9.45		5.88	.47
CaO.....				1.94		
MgO.....				2.40		
Na ₂ O.....				1.84		
K ₂ O.....				.93		
H ₂ O-.....				6.46		
H ₂ O+.....				0.02		
Cl.....				.95		
S.....				.20		
CaCO ₃						93.73
MgCO ₃						57

- I. Twenty feet from the east bank of French canal, opposite middle of dry-dock slip, in 20 feet of water.
 II. Middle of French canal, halfway between dry dock and mouth of Mindi, opposite triangulation tower.
 III. Middle of canal at water surface, mouth of Mindi.
 IV. Mixture of equal weights of I, II, and III.
 V. Rhyolite tuff west end of Panama Railroad bridge across Culebras, San Pablo.
 VI. Coral from Limon Bay, Colon, Panama.
 I, II, III, IV, and VI. E. W. Schaller, analyst.
 V. E. C. Sullivan, analyst.

It will be seen from these analyses that the coral is a remarkable pure lime carbonate. The muds, although thought to be rather low in silica, contain a relatively large amount of iron as compared with alumina, and for this reason it was believed that they might make a cement capable of resisting the decomposing effects of sea water. The composition of the rhyolite tuff is so near the average composition of the argillaceous materials used in the Lehigh district that at the time it was believed this, in combination with the coral, would make the better grade of cement. In any case the analyses were sufficiently promising to warrant actual burning tests, and so 600 pounds of the coral rock and 100 pounds each of the mud and the rhyolite tuff were shipped, at my request with the approval of the chief engineer, from the Isthmus to the Lehigh Valley testing laboratory at Allentown, Pa. Three separate burnings were made and the results are tabulated below.

In the first burning the mixture was coral rock and clay, in the second coral and rhyolite tuff while the third burning, made some six weeks after the first two, was of equal parts of clay and tuff combined with the coral as a base.

BURNING TESTS OF CEMENT MATERIALS FROM PANAMA.

[Made at the Lehigh Valley testing laboratory.]

Chemical analyses.

FIRST BURNING.

	Raw material.		Calculated.		As analyzed.	
	Coral, 2.8.	Clay, 1.	Mix.	Clinker.	Mix.	Clinker.
SiO ₂	0.89	49.91	13.79	21.56	13.93	21.08
Fe ₂ O ₃.....	.36	10.06	2.91	4.58	2.89	4.64
Al ₂ O ₃.....	.32	15.48	4.31	6.79	4.25	6.73
CaO.....	52.62	6.98	40.61	63.95	41.22	63.00
MgO.....	.38	2.27	.87	1.37	.89	1.09
SO ₂.....					.63	1.06
Loss on ignition.....	43.50	12.92				

SECOND BURNING.

	Raw material.		Calculated.		As analyzed.	
	Coral, 3.33.	Tuff, 1.	Mix.	Clinker.	Mix.	Clinker.
SiO ₂	0.89	60.93	14.75	22.63	14.39	22.83
Fe ₂ O ₃.....	.36	5.46	1.54	2.39	1.80	2.87
Al ₂ O ₃.....	.32	15.86	3.91	6.08	3.93	6.32
CaO.....	52.62	4.02	41.43	64.43	42.12	64.32
MgO.....	.38	1.79	.71	1.10	.84	1.58
SO ₂.....					.41	.34
Loss on ignition.....	43.50	10.44				

THIRD BURNING.

	Raw material.			Calculated.		As analyzed.	
	Coral, 30.	Clay, 5.	Tuff, 5.	Mix.	Clinker.	Mix.	Clinker.
SiO ₂	0.89	49.91	60.93	14.19	22.42	14.53	22.75
Fe ₂ O ₃.....	.36	10.06	5.46	2.16	3.41	2.30	3.67
Al ₂ O ₃.....	.32	15.48	15.86	4.06	6.41	4.09	6.42
CaO.....	52.62	6.98	4.02	41.13	64.97	41.21	64.57
MgO.....	.38	2.27	1.79	.78	1.23	.85	1.58

Specific gravity.

Coral-clay cement.....	3.23
Coral-tuff cement.....	3.20
Coral-clay-tuff cement.....	3.17

Fineness.

	Sieve—		
	No. 50.	No. 100.	No. 200.
	Per cent.	Per cent.	Per cent.
Coral-clay cement.....	100	98	90.3
Coral-tuff cement.....	100	99	93.3
Coral-clay-tuff cement.....	100	95	88.6

SOUNDNESS.

All the pats for each cement were reported sound and hard on the completion of the tests, but after a month or six weeks some became detached from the glass. The pats were made from freshly burned clinker, ground as soon as cold, and without the addition of plaster. A very good showing for a laboratory test.

Setting time.

(2 per cent plaster added.)

	Initial set.		Final set.	
	A.	M.	A.	M.
Coral-clay cement.	1	45	5	25
Coral-tuff cement.	1	27	6	47
Coral-clay-tuff cement.	1	30	5	30

Tensile strength of briquettes.

(Pounds per square inch.)

CORAL AND CLAY

	Neat				Standard sand, 3 to 1.		
	24 hours	7 days	28 days	3 months	7 days	28 days	3 months
1	200	630	726	756	190	398	398
2	250	600	732	749	230	321	340
3	261	670	686	700	206	285	300
Mean.	237	633	719	735	206	301	305

a Broken at 21 hours

Gauge water: neat, 21 per cent, sand, 11 per cent, 2 per cent plaster of Paris added.

CORAL AND TUFF.

	Neat				Standard sand 1 to 1		
	24 hours	7 days	28 days	3 months	7 days	28 days	3 months
1	1	42	60	60	241	398	397
2	60	80	60	60	24	115	100
3	—	—	60	60	2	123	100
Mean.	210	70	60	60	257	100	100

Gauge water: neat, 22 per cent, sand 11 per cent.

CORAL, CLAY, AND TUFF

	Neat			Standard sand 3 to 1	
	24 hours	7 days	28 days	7 days	28 days
1	263	632	711	165	315
2	280	706	733	180	300
3	280	611	757	175	290
Mean.	288	613	734	173	302

Gauge water: neat, 22 per cent, sand 11 per cent, 2 per cent plaster of Paris added.

Although there are certain differences in the chemical composition of the two kinds of argillaceous materials, the results of the tests are remarkably uniform, and might well have been of three separate burnings of the same materials, and all three are entirely satisfactory.

The slightly lower strength of the rhyolite-coral cement is doubtless due to the finer grinding of this clinker; if ground to only 94 per cent or 95 per cent on a 100-mesh sieve, the strength would probably be 100 pounds higher at seven and twenty-eight days. The fineness of the third burning is nearer the average commercial standard.

In general the strength of the cement can be regulated at will by varying the composition of the raw mix and the degree of hardness in burning. Burned in a rotary kiln on a commercial scale, cement of the composition of the trial burnings would undoubtedly develop a strength of 800 pounds at seven days. The alumina is not so high as to preclude the possibility of burning a lower limed mixture if desired.

Without the addition of plaster the setting time of the rhyolite-coral cement is too quick, but this is also a matter that can be readily corrected in arranging the mix and burning.

Considering the reports as a whole, it may be said that the materials tested are suitable for the manufacture of the highest grade of Portland cement and, according to the manager of the testing laboratory, make a better showing than the average standard brands from the Lehigh district tested at the same laboratory.

PHYSICAL CHARACTER OF THE RAW MATERIALS.

Coral.—The coral rock is of very moderate hardness and may be easily obtained either by dredging or surface excavation of reefs bordering the coast. It may be crushed with little difficulty and would require no drying.

Clay.—The clay or mud from the Chagres or the French canal may be easily and cheaply dredged. Its uniformity of composition is undoubted, and the only serious expense connected with the use of this material would be in the drying. It is possible that a wet process might be found, in this case, more economical than the generally used dry process.

Tuff.—The rhyolite tuff is soft and easily quarried and crushed. Its location near the Panama Railroad is an advantage in the matter of shipment, but the distance (about 20 miles) from the point where the coral could be profitably delivered would be the most serious objection to the use of this material.

AMOUNT OF RAW MATERIAL AVAILABLE.

Taking 5,000,000 barrels as the total amount required, this would call for about 1,500,000 tons of raw materials, of which 1,125,000 tons would be of the coral and the remaining 375,000 tons of the clay or its equivalent—that is, coral rock would have to be excavated to a depth of 1 yard over an area a little less than one-half of a square mile, considering 1 cubic yard of coral in place as weighing 1 ton, which is a generous estimate. A very large part of the required amount of coral could be obtained from the beach at Colon by surface excavation.

In round numbers, the 375,000 tons of clay would represent the excavation of as many cubic yards by dredging to a depth of 6 feet over an area 100 feet wide and $3\frac{1}{2}$ miles long. Mud from the canal, Chagres, or diversions at any point below Gatun, would be available for this purpose, and in amounts far in excess of those required for 5,000,000 barrels of cement.

The weight of the rhyolite tuff is something over 1 ton to the cubic yard, but considering, for simplicity in calculation, that this is the equivalent weight, 375,000 cubic yards would be required. Half as much again of this material is in sight at the west end of the railroad bridge crossing the Chagres at San Pablo, and probably four or five times this amount is available as a conservative estimate.

Speaking generally, it may be said that the amount of coral is far beyond that required for twice the number of barrels of cement estimated upon, while the same is equally true of the clay and rhyolite tuff.

KINDS OF MATERIAL TO BE USED.

With so little difference in the chemical composition and physical properties of the three kinds of cement made from the clay, or rhyolite tuff, or combination of both, with the coral as a base, the deciding factor in determining the kind of material to be used is the cost of the raw materials. In this there would appear to be a decided advantage in favor of the mud or clay from the Chagres or canal. This may be obtained entirely by dredging and transported by water directly to the mill, which would be most favorably located at some point midway between Gatun and Colon. As has been said, the principal objection to the use of the clay would be the necessity of drying before burning. By the accumulation of large stock reserves, most of this drying could take place in air, if protected from rain, and the cost would be considerably reduced.

Although the rhyolite tuff would not have to be dried before grinding, the cost of transportation from San Pablo to the mill would be excessive.

FUEL

Three kinds of fuel may be used in operating the mill and in the kilns—coal from the United States, oil, or local lignites. The relative cost of oil and coal is about the same at the prices now prevailing on the Isthmus—that is, \$4.50 a ton for coal and 80 cents a barrel for oil. It is believed, however, that the fuel value of the oil would be greater and its efficiency could be increased above that of the coal. As mentioned later, the reported deposits of lignite occurring in the vicinity of Tabernilla might be considered in the manufacture of cement. Fuel of this type is of low grade and used directly would be of little value, but the high percentage of volatile matter present in the lignite could be taken advantage of by means of the gas producer and used both in the kilns and for power.

COSTS.

The estimated cost per barrel of finished cement is as follows:

Raw materials	\$0 15
Coal	68
Fuel oil	12
Plant and interest	39
Total	1 34

This estimate is based on the following unit costs:

	Per Ton
Clay and dredged mud delivered at mill	\$0 20
Coral	50
Coal	4.50

A plant having a minimum capacity of 1,000,000 barrels a year would call for twelve 110-foot rotary kilns, and would cost about \$1,500,000. The item of 39 cents for plant and interest in the cost per barrel would absorb the plant and pay interest at 6 per cent in five years.

One of the largest costs for labor in a commercial plant in this country is for packing the cement, and this could be eliminated on the Isthmus.

All these costs are, in my opinion, maximum ones and might be considerably reduced in practice.

If oil were used in place of coal, taking into account the added efficiency, the price for fuel could undoubtedly be reduced to 50 cents a barrel. A serious objection to the use of oil, however, would be the dependence upon one kind of fuel, possibly from one source, and the consequent difficulty of controlling prices and insuring a constant supply.

The use of gas derived from lignite would probably reduce the cost still further if an abundance of this material of good quality could be obtained on the Isthmus. It is unlikely that a sufficient quantity of this fuel exists at points convenient for mining to justify the installation of a gas-producing plant, so that should the manufacture of cement be undertaken coal from the United States would probably be the best fuel to use.

EFFECT OF CLIMATE.

The extreme humidity existing at all times of the year, and especially in the rainy season, would probably have no harmful effect on the finished cement. If anything, the humidity would be an advantage in hastening the process of aging, which, as it is now understood, consists merely in the slaking of the free lime that is present in the cement immediately after burning.

CONCLUSION.

In conclusion it may be said with confidence that Portland cement equal to the best grades manufactured in the United States or Europe may be made on the Isthmus and at a cost not greater than \$1.34 a barrel, and probably less.

LIGNITE.

Thin seams of lignite are not uncommon in the clays and shales of the Culebra beds exposed in the cut between Empire and Gold Hill. Traces of lignite have also been found at a number of other places on the Isthmus. Coal mines were referred to in the Lull report of 1879 as occurring in the Rio Indio drainage west of the present Canal Zone, the deposits being reached from Puerto Condido on the Atlantic side or from Chorrera on the Pacific. Even if this coal exists as reported, the cost of mining and transportation would be so high as to prohibit its use.

At the request of the chief engineer I examined properties in the vicinity of Tabernilla said to contain large deposits of coal. At the time of the examination, in August, 1906, the test pits that had been sunk in prospecting for the coal were completely filled with water or earth, so that there was no means of discovering the character of the reported deposit. The small amount of material remaining at the sides of the pits indicated that the so-called coal was in reality a low to medium grade lignite.

A report made by a French engineer stated that the material was of excellent quality and occurred in a seam 3 meters, or about 10 feet, thick, which underlies a thinner seam of coal of inferior grade. Approximately 1,000,000 tons were reported as available.

In my opinion it is extremely improbable that any deposit of such magnitude exists at this locality. It is unlikely, also, that the lignite if mined would prove to be satisfactory as a fuel, and combining costs and efficiency there would be little or no advantage in using these lignites instead of good coal from the United States.

There is a possibility that fuel of this character might be valuable for gas-producing purposes in the manufacture of cement as already pointed out.

In my report to the chief engineer of August, 1906, I stated that in my opinion it was desirable to have some prospecting done by means of drills in the vicinity of these reported deposits, in order to obtain some reliable information as to their extent and quality. As a part at least of the so-called coal lands will be submerged by the Gatun Lake it would be well to have some data upon which to base the value of such lands in case of condemnation.

The test pits referred to are located on the banks of a small stream, the Rio Negro, entering the Rio Frijoles from the northeast. The locality is reached by a road or trail, and is about 1½ miles northeast of Tabernilla, near a large ranch.

In making the borings all the core should be saved, and samples of the coal or lignite should be sent to the Geological Survey for analysis, together with the complete boring records.

Should coal be found as reported in the vicinity of the old test pits, further prospecting should be carried on by drilling in order to discover the extent of the deposit—that is, lines should be run at right angles to one another from the first test hole as a center, and borings made on these lines at intervals of from 100 to 200 feet for distances of at least 1,000 feet in each direction from the center.

GENERAL SUMMARY.

Excavation in Culebra Cut. No difficulties are to be anticipated in continuing the excavation in the Culebra region except at Contractors Hill, where it is possible, but not probable, that landslides may take place when lower levels are reached. Should this danger present itself, it may be overcome by a reduction in the angle of slope.

Sites for dams and locks. The rocks at all points where locks are to be constructed are firm and hard and will make excellent foundations for the lock walls.

The materials underlying the sites selected for the various dams will be competent to support the dams and will be impervious to water.

Materials for use in masonry construction. *Rock.* There is an abundance of rock suitable for crushing near all points where such material will be needed.

Sand. Sand for building purposes has been found in large quantity on the Pacific coast at Chorrera, while that needed on the Atlantic side may be obtained in the vicinity of Porto Bello.

Cement materials. Raw material from which high-grade Portland cement can be cheaply manufactured on the Isthmus has been found in quantities sufficient to supply all of the cement needed.

Lignite. No coal has been found on the Isthmus, but small deposits of low-grade lignite have been found that are of no commercial value.

ERNEST HOWE, *Geologist.*

APPENDIX F.

ANNUAL REPORT DEPARTMENT OF LABOR, QUARTERS, AND SUBSISTENCE, JULY 1, 1906-JUNE 30, 1907.

Average monthly force, July to June.

Month.	Construc- tion and engineer- ing.	Labor, quarters, and sub- sistence.	Law and govern- ment.	Sanita- tion.	Disburs- ing.	Audit- ing	Total.
July.....	13,636			2,786			16,422
August.....	14,058			3,012			17,070
September.....	14,117			2,931			17,048
October.....	14,078			3,028			17,106
November.....	13,716	924	412	2,659	93	68	17,872
December.....	15,149	1,040	312	2,838	88	58	19,485
January.....	16,254	1,148	357	3,106	98	57	21,020
February.....	18,520	1,341	375	2,645	99	57	23,037
March.....	19,564	1,440	339	2,618	96	62	24,119
April.....	20,000	1,341	402	2,150	97	72	24,267
May.....	20,102	1,403	622	2,280	101	62	24,570
June.....	18,810	1,728	420	2,168	112	63	23,327

NOTE. Prior to November, 1906, reports were consolidated under the heads of "Construction and engineering" and "Sanitation."

The force report has shown a steady increase. The decrease in June was made up by a large increase in the Panama Railroad force, the laborers being furnished from the Isthmian Canal Commission force.

Classified force, June 30, 1907.

From United States.....	4,404
Europeans.....	4,317
West Indians.....	14,606
Total.....	23,327

Panama Railroad force.

From United States.....	1,140
West Indians.....	4,979
Total.....	6,119

Statement of changes made each month in the gold personnel of the force on the Isthmus.

Month.	Employed in United States.	Employed on Isthmus.	Total employed.	Separa- tions.	Net ad- ditions.
July.....	155	187	342	274	68
August.....	183	169	352	350	2
September.....	294	204	498	266	232
October.....	324	187	511	318	193
November.....	428	181	619	464	155
December.....	126	223	349	331	18
January.....	182	277	459	478	19
February.....	307	234	530	251	289
March.....	272	254	526	333	193
April.....	284	336	620	419	201
May.....	227	250	477	432	45
June.....	252	200	512	442	70
Total.....	3,038	2,766	5,804	4,307	1,437

* Loss.

NOTE.—Amount expended for transportation of skilled labor to the Isthmus, \$136,710.

Laborers brought to the Isthmus at the expense of the Commission.

From—	July to December						Total.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Curacao, D. W. I.			23				23
Bordeaux.....					178	126	304
Santander.....					160	163	323
St. Nazaire.....					297	382	679
Vigo.....				229	200	309	608
Martinique.....					4	561	565
Barbados.....	858	290	163	110	763	195	2,379
Trinidad.....					638	441	1,079
Total..	858	290	186	340	1,732	2,745	8,151

From	January to June.						Total.
	Jan.	Feb.	Mar.	Apr.	May.	June	
Panama (Chiriqui).				13			13
Bordeaux.....	151	136	58	599	142	62	1,108
Santander.....	359	297	306	200	378	171	1,711
St. Nazaire.....	192	154	338		271	118	1,073
Vigo.....	207	163	119	137	194	48	858
Barcelona.....						35	35
Martinique.....	379		876				1,255
Barbados.....	2,446	1,294					3,740
Guadeloupe.....			713	401	728		1,842
Total...	3,734	2,044	2,410	1,370	1,703	434	11,695

Grand total, 17,846. Europeans, 8,809.

The men brought from Vigo, Santander, and Barcelona were Spaniards, those from St. Nazaire and Bordeaux, Italians, Greeks, and French. The Royal Mail Steam Packet Company brought Europeans from Vigo, all negroes from Barbados and Trinidad and the majority of those from Martinique and Guadeloupe. The Compagnie Generale Transatlantique brought Europeans from Bordeaux, Santander, and St. Nazaire, and the balance of the negroes from Martinique and Guadeloupe.

Amount expended for transportation of laborers to Isthmus.

From	July 1 to December					
	July	Aug.	Sept.	Oct.	Nov.	Dec.
Curacao, D. W. I.		\$1,200				
Martinique					\$44.00	\$4,956.40
Europe				\$8,141.74	45,675.40	36,756.40
Barbados	\$9,621.00	2,446.00	\$1,300.20	1,140.02	1,404.00	5,493.60
Trinidad					4,593.60	3,175.20
January to June,						
From	Jan.	Feb.	Mar.	Apr.	May	June
Martinique	\$3,800.00	\$6,397.20				
Europe	\$3,700.2	27,480.00	\$30,240.88	\$34,215.98	\$36,134.63	\$15,902.70
Barbados	\$6,400.00	1,400.00				
Guadeloupe			1,131.00	1,119.20	7,241.60	
Panama (Chiriqui)				25.00		

Total for transport of laborers for year \$81,736.48

The following statement shows the immigration and emigration, by months, during the fiscal year, at the port of Colon, through which port practically the entire flow of labor for the canal comes and goes:

Months.	Immi- gration.	Emigra- tion.	Months.	Immi- gration.	Emigra- tion.
July.....	2,516	1,250	February.....	2,574	1,392
August.....	1,860	1,358	March.....	2,454	1,814
September.....	1,787	1,366	April.....	2,295	2,128
October.....	2,454	1,816	May.....	2,348	2,558
November.....	2,262	1,779	June.....	2,771	1,987
December.....	1,750	2,135			
January.....	2,953	1,307	Total.....	28,024	20,890

Making a total of 7,134 in favor of immigration during the entire fiscal year. This includes both cabin and steerage, with the latter largely in preponderance. The figures given do not include the contract laborers brought to the Isthmus at the expense of the Commission.

During the fiscal year the Department has recommended the construction of the following buildings:

Dormitories.....	13	Assembly hall and church.....	1
Kitchens.....	36	Bath house.....	1
Laundry buildings.....	4	Range closet.....	1
Mess halls.....	4	Sheds for ice.....	2
Cooking sheds.....	65	Stable.....	1
Bunk houses.....	20	Type 5.....	37
Colored married quarters.....	10	Type 7.....	10
Gallego messes.....	10	Type 8.....	7
Office buildings.....	2	Type 8-A.....	1
Hotel-help's quarters.....	1	Type 10.....	2
Dispensary buildings.....	2	Type 14.....	76
Storerooms.....	4	Type 15.....	41
Commissary-help's quarters.....	1	Type 16.....	7
Commissaries.....	6	Type 17.....	46
Hotels.....	3	Type 18.....	15
Boiler sheds.....	1	Type 19.....	3
Fumigators.....	8		

Buildings for all purposes in use June 30, 1907.

Houses for skilled married employees.....	537
Houses for skilled bachelor employees.....	223
Houses for unskilled married employees.....	329
Houses for unskilled bachelor employees.....	528
Hotels.....	16
Mess halls.....	19
Kitchens.....	55
Miscellaneous (offices, storehouses, clubhouses, bath houses, etc.).....	501
Total.....	2,208

SUBSISTENCE.

Our operations for the past fiscal year show a gain of \$12,971.54 on hotels and a gain of \$59,385.44 on kitchens. A profit was shown each month on the operation of both hotels and kitchens, with the exception of June, in which month a loss of \$3,755.32 was experienced on the hotels. This gives a total net income for the year of \$72,356.98. From this should be deducted \$7,487.66, loss on the Washington Hotel and Hotel Tivoli, leaving an apparent gain for the year of \$64,869.32.

The profits of the subsistence department are not as large as they appear. The amount allowed for depreciation of plant is too small, and there are various other items which have not been considered. The profits, however, have been sufficient to pay for all the equipment bought, exclusive of buildings and fixtures.

On June 30, 1907, we were operating 16 hotels for furnishing meals to American white employees, 18 messes for Europeans, and 23 kitchens for natives of the West Indies. We serve approximately 1,000,000 meals per month.

Statements following show operations of hotels and kitchens by months:

HOTELS.

Month.	Expense.	Income.	Gain.
July....	\$23,061.03	\$24,806.75	\$1,745.72
August.....	27,514.04	27,508.10	84.06
September...	27,908.01	29,162.00	1,196.36
October.....	31,920.58	33,821.61	1,443.03
November.....	37,155.40	37,565.10	409.70
December...	42,994.07	44,550.82	1,555.15
January.....	42,690.74	44,148.88	1,458.14
February.....	39,056.57	42,175.45	3,118.88
March.....	45,569.06	46,811.39	1,242.33
April.....	51,211.43	52,404.58	1,193.15
May.....	52,843.54	53,104.63	261.09
June.....	57,808.81	54,053.40	.....
	475,987.54	492,694.40	16,706.86
Loss.....			3,755.32
Net gain.....			12,951.54

Washington Hotel shows a loss for the year of..... \$620.34
Hotel Tivoli shows a loss since January 1, 1907..... 6,967.32

New hotels were opened at the following places during the past fiscal year: Las Cascadas, September 17, 1906; Tabernilla, August 2, 1906; Gatun (2), July 24, 1906, and May 15, 1907; and Porto Bello, May 10, 1907.

KITCHENS.

Month.	Expense.	Income.	Net gain.
July.....	\$6,326.10	\$7,671.92	\$1,345.82
August.....	4,332.11	5,112.22	780.11
September...	4,875.18	5,729.63	854.45
October.....	5,450.96	6,850.38	1,399.42
November.....	10,086.18	12,129.85	2,043.67
December.....	20,544.97	24,654.80	4,109.83
January.....	12,930.46	15,480.26	2,549.80
February.....	66,128.33	78,139.65	12,011.32
March.....	74,511.07	89,020.60	14,509.53
April.....	78,915.78	86,639.36	7,723.58
May.....	80,521.58	90,273.07	9,751.49
June.....	80,724.88	83,922.00	3,197.12
	624,473.30	725,632.74	101,159.44

TABLE.

Month.	Expense.	Income.	Net gain.
July.....	463	1,088	1,047
August.....	253	1,210	1,210
September...	207	1,304	1,304
October.....	207	1,202	1,202
November.....	207	1,202	1,202
December.....	207	1,202	1,202

COST.

Month.	Admin- istra- tion.	Labor agents.	Clerks.	Foremen janitors.	Subsistence.			Total.
					Stewards' clerks.	Cooks.	Walters' helpers.	
July.....	\$1,350.00	\$1,600.00	\$6,230.02	\$8,081.35	\$929.82	\$1,102.90	\$2,668.92	\$21,963.01
August.....	1,683.34	1,650.00	6,879.31	8,707.28	1,003.93	1,201.33	2,708.07	23,833.26
September.....	1,683.34	1,679.17	5,610.96	9,962.16	1,788.23	1,437.15	2,794.53	25,091.58
October.....	1,683.34	1,650.00	6,704.09	12,881.76	2,265.63	1,393.36	3,156.64	29,534.82
November.....	1,683.34	1,650.00	7,094.11	14,052.60	2,568.54	1,694.45	3,589.33	32,332.46
December.....	1,683.34	1,650.00	8,207.45	15,223.22	2,783.49	2,060.74	5,188.08	36,796.32
January.....	1,916.67	1,650.00	7,562.40	15,806.96	4,779.19	3,609.08	8,393.38	43,717.68
February.....	2,166.67	1,650.00	7,972.16	15,885.37	5,134.62	5,313.99	9,497.20	47,570.01
March.....	2,166.67	1,650.00	8,548.75	16,332.20	5,543.86	5,151.76	10,434.33	49,827.57
April.....	2,166.67	1,650.00	8,242.15	17,265.99	6,893.72	6,245.12	8,865.92	51,329.57
May.....	2,166.67	1,650.00	9,921.38	18,630.72	6,277.24	5,523.48	10,680.72	54,850.21
June.....	2,166.67	1,650.00	9,694.34	21,809.59	6,282.21	5,653.25	10,650.38	57,906.44
Total.....					46,250.48	40,386.61	78,617.50	474,752.93

Total subsistence, \$165,254.59. The subsistence item of \$165,254.59 is included in the expense of operation of hotels and kitchens. The net cost of operation of the department of labor, quarters, and subsistence for the period is, therefore, \$309,498.34.

Respectfully submitted.

JACKSON SMITH,
Manager.

Col. GEO. W. GOETHALS,
Chairman and Chief Engineer, Culebra.

APPENDIX G.

REPORT OF THE HEAD OF THE DEPARTMENT OF CIVIL ADMINISTRATION.

ANCON, *September 10, 1907.*

SIR: I have the honor to inclose herewith annual report of the department of civil administration for the twelve months ended June 30, 1907.

Very respectfully,

JO. C. S. BLACKBURN,
Head of Department of Civil Administration.

The CHAIRMAN, ISTHMIAN CANAL COMMISSION,
Culebra.

ISTHMIAN CANAL COMMISSION,
DEPARTMENT OF CIVIL ADMINISTRATION,
Ancon, August 23, 1907.

SIR: I have the honor to submit the following report of the department of civil administration of the Isthmian Canal Commission for the period from October 1, 1906, to June 30, 1907.

This department was first organized by the Canal Commission in September, 1904, as "the government of the Canal Zone." Its functions were to exercise the judicial and executive rights of government in the Canal Zone acquired by the United States under the treaty with Panama.

Although the department has undergone several changes since its original organization, it still remains in fact what it was then in name. The enforcement of law, the maintenance of order, and "the protection of the inhabitants of the Zone in their persons and property and in their private rights and relations" are still its duties. It is a department of the Canal Commission coordinate with other departments and cooperating with them for the accomplishment of the work the United States has undertaken here. But it will continue to exist and to discharge its duties long after the canal is an accomplished fact. As it was necessary before the work of construction was begun that there should be established a government in the Zone, so will it be necessary that that government shall exist after the work of construction is completed. It is only by recognizing the fact that we are building here a government for all time, and, as the President said in his letter of instructions of May 9, 1904, building it upon principles which have been made the basis of our existence as a nation, that we can hope to make that government one that will command the confidence and respect not only of our own people, but also of the world at large.

The last report of the governor of the Canal Zone was submitted October 1, 1906, and in it the work of the department was brought up to September 30, 1906. Governor Magoon left the Isthmus September 25, 1906, and the duties of the head of the department of government and sanitation, as the department was then known, were performed by the executive secretary from that time until November 17. The Executive order of that date divided the Commission into seven departments, with the general counsel at the head of one and provided:

The general counsel shall have charge of (1) all legal matters pertaining to the Commission, whether in the United States or on the Isthmus of Panama; (2) the administration of civil government within the Canal Zone, and shall exercise, through a local administrator, the authority heretofore vested in the governor of the Canal Zone.

The general counsel returned to the United States November 25, leaving the executive secretary in charge of the Zone government, under an order issued by authority of the Commission.

On April 2 the Secretary of War, by direction of the President, issued an order vesting the authority of the governor or chief executive of the Canal Zone in the chairman of the Commission. The chairman exercised that authority until May 9, when the undersigned, a member of the Canal Commission, was placed in charge of the Zone government as "head of the department of civil administration," under an order issued by the chairman of the Commission.

By the order of November 17, 1906, the health department was separated and made independent.

The department as now organized includes the executive office, the courts of the Canal Zone, the office of the prosecuting attorney, the divisions of revenues, posts, customs, lands, administration of estates, police, education, fire protection, and public works. The head of the department also represents the Commission in its relations with Panama and with foreign consuls accredited to Panama whose jurisdiction extends to the Canal Zone.

LEGISLATION FOR THE ZONE.

The act of Congress approved April 28, 1904, provided that until the expiration of the Fifty-eighth Congress all the military, civil, and judicial powers, as well as the power to make all rules and regulations necessary for the government of the Canal Zone, and all the rights, powers, and authority granted by the terms of the treaty to the United States, should be vested in such person or persons and exercised in such manner as the President should direct. By a letter of May 9, 1904, addressed to the Secretary of War, the President directed that these powers should be vested in and exercised by the Canal Commission until the close of the Fifty-eighth Congress. In the exercise of them the Commission enacted various laws for the government of the Zone. The power of the Commission, however, to legislate for the Zone ceased to exist on March 4, 1906, when the Fifty-eighth Congress expired. After that date the authority to legislate for the Zone reverted to the President.

In the exercise of this authority the President, and by his direction the Secretary of War, signed during the year several important Executive orders, among them orders abolishing the five municipalities and creating in their stead administrative districts; extend-

ing the United States patent, trade-mark, and copyright laws to the Zone; regulating insurance companies; providing for the registration of land titles and the celebration of marriages; amending the penal laws, and putting in force a new code of civil procedure.

By the order of March 13, 1907, the Commission is authorized to enact, with the approval of the Secretary of War, ordinances relating to police, sanitation, and taxation, and any other matters theretofore regulated by municipal ordinances. Under this authority the Commission has enacted ordinances regulating the sale of liquor and prescribing certain taxes in the Zone.

Since the order governing insurance companies in the Canal Zone became effective no company has qualified for business.

The rates of fire insurance in the Zone, because of the inflammable character of the buildings, have been very high in the past, and it is reported that the annual fee of \$50 required of each company, in addition to the tax of $1\frac{1}{2}$ per cent on its premium receipts, constitutes a burden which no company has yet felt able to carry at the old rates of insurance. It is desirable to encourage both fire and life insurance in the Zone, and it is believed that if the taxes provided for by that order were reduced advantage would result to the inhabitants of the Zone. The character of the companies doing business in the Zone would be assured by the other provisions of the order.

RELATIONS WITH PANAMA.

The relations between the Commission and Panama are, and have been during the past year, very satisfactory. Many important questions have been discussed, and, with few exceptions, disposed of satisfactorily.

Building regulations in Colon.—The demand for buildings at Colon gave rise during the year to a tendency to ignore sanitary requirements in the construction and location of new buildings.

The chief sanitary officer prepared a draft of building regulations, which, after discussion and amendment, was published in April as a decree of the President of Panama. Marked improvement in the character of buildings under construction at Colon has resulted from the enforcement of these regulations.

The joint commission.—Shortly after the fire in Panama in January, 1906 (which was believed by many people of the city to have been caused by the fumigation work of the health department), the question of the authority of the Canal Commission to reimburse property owners who suffered loss from it was submitted to the Comptroller of the Treasury. He advised the Commission that it had not authority to settle and pay the claims, but intimated that they should be submitted to the joint commission provided for by the canal treaty.

These claims and the value of private lands in the Zone in the neighborhood of Panama required for the Commission's use gave rise to negotiations which resulted in the formation of the joint commission in April of this year. Messrs. B. S. Ambler and Montgomery Blair representing the United States and Messrs. C. Arosemena and S. Lewis the Republic of Panama.

After sessions extending over nearly two months, most of which were devoted to taking testimony, the commissioners were unable to agree upon the value of any of the property the determination of which was

submitted to them, except the islands in Panama Bay and the improvements upon them.

The American members of the joint commission made to the Secretary of War a report of the proceedings and of their inability to agree with the Panama members, who made a similar report to the secretary of foreign affairs of Panama. All the proceedings, including the testimony and documentary evidence, were reported and preserved.

It appears from the reports submitted by the American and Panama members that they were hopelessly at variance, the Panama members voting for values ranging from five to a hundred times the values voted for by the American members.

It is greatly to be regretted that the commission was unable to reach a conclusion. Under the terms of the treaty, the United States is occupying most of the properties, the value of which was submitted to the joint commission, and the Canal Commission's work is, therefore, not interfered with by the delay. But the owners of the properties, some of which have been occupied ever since the Commission entered upon its work on the Isthmus, are entitled to have the values determined and payment made as early as that can be done. Justice to them requires that an early effort should be made to agree with Panama upon an umpire, as provided for by the treaty, to decide the value of the property, upon the evidence taken by the joint commission.

The Pacific Mail Steamship Company claims title to an undivided one-half interest in the islands of Naos, Culebra, and Flamenco, in Panama Bay. The value of this interest was submitted to the joint commission, and the members reached a unanimous agreement upon it. They also agreed upon the value of the buildings belonging to the Pacific Mail Steamship Company on the island of Flamenco, which were desired by the health department for use as a quarantine station. Since their report was made, however, it has been decided not to use those buildings, but to construct new buildings on the island of Culebra.

As to the claims originating from the Malambo fire, it would seem that the joint commission's authority was limited to an ascertainment of the value of the property destroyed. The general counsel of the Commission and the secretary of government and foreign relations of Panama sought to enlarge the powers of the commission so as to enable it to ascertain and determine whether the fire was caused by the negligence of employees of the Canal Commission, in carrying out the necessary work of fumigation, as is evidenced by the correspondence herein inserted:

ANCON, April 5, 1907.

MR. SECRETARY. In view of your contention that under the terms of the treaty the joint commission is authorized to pass upon values only, and not to determine specific questions of fact or law, I now propose that, by a special agreement, we stipulate that the joint commission, which we are now about to assemble to pass upon, among others, the claims for damages alleged to have been caused by our sanitary department in the work of fumigation in the city of Panama, be authorized to determine, in addition to the question of value, the question—Whether the fire in the Malambo district was caused by the negligence of the employees of the Isthmian Canal Commission in carrying out the necessary work of fumigation.

I have the honor to remain very respectfully, yours,

RICHARD REID ROGERS,
General Counsel.

HIS EXCELLENCY RICARDO ARIAS
Secretary of Government and Foreign Affairs, Panama.

[Translation.]

SECRETARY OF GOVERNMENT AND FOREIGN RELATIONS,
DEPARTMENT OF FOREIGN AFFAIRS,
Panama, April 9, 1907.

SIR: In reply to your esteemed communication, dated the 5th instant, with reference to the joint commission which is about to convene, in conformity with Articles VI and XV of the canal treaty, I take pleasure in informing you that, in compliance with instructions from His Excellency the President of the Republic, the National Government accepts the proposal contained in said communication, which is that the joint commission will conscientiously decide, as an advisory board, if, in the opinion of its members, the Malambo fire was caused by the negligence of the employees of the sanitary department, while carrying out the work of fumigation.

With sentiments of high consideration, I am, your obedient servant,

RICARDO ARIAS.

HON. RICHARD REID ROGERS,

General Counsel, Head of the Department of Government of the Canal Zone.

Evidence was taken, and the claims were considered by the joint commission, which reported that, being unable to determine the origin and cause of the fire, it was of the opinion that the claims should be compromised, and recommended the payment by the United States to the claimants of amounts aggregating \$54,037. No action has been taken to give effect to the findings of the commission.

Central and South American Telegraph Company's "All American" cable—In order to land the new "All American" cable in the Canal Zone, the Central and South American Telegraph Company made application for authority to bring it through Manzanillo Bay, on the east of Manzanillo Island. Under the provisions of the provisional agreement of delimitation signed by General Davis and representatives of the Panama Government June 15, 1904, Colon harbor is described as "that part of Limon Bay lying north of a line drawn due west from the Columbus statue on Cristobal Point." Limon Bay was understood to be the bay south of a line drawn from the light-house on Manzanillo Island to Point Toro.

When the question of laying the cable through Manzanillo Bay came up a description of the boundaries of Colon Harbor was submitted to the Panama Government, and the secretary of foreign affairs of that Government agreed that under the provisional agreement of delimitation Colon Harbor is bounded on the south by a line drawn due west from the Cristobal statue, and on the north by a line drawn from the Colon light-house to the light-house on Point Toro, excepting a channel 333 meters on each side of the center line of the canal running through the harbor. This left all the other water surrounding Manzanillo Island, extending to the 3-mile limit and including Manzanillo Bay, under the jurisdiction of the United States.

Authority was therefore granted to the telegraph company to land the cable as desired. The Panama Government requested that the authority be suspended until the cable company should first secure permission from that Government, on the grounds (1) that the waters of the Caribbean Sea, adjacent to the Isthmus, outside the 3-mile limit, as referred to in the treaty, through which the cable must pass in entering Manzanillo Bay, are under the jurisdiction of Panama; and (2) that the delimitation of Colon Harbor, placing Manzanillo Bay under the jurisdiction of the United States, is only provisional, and a permanent delimitation may place the cable within the jurisdiction of Panama. As the waters of the Caribbean Sea outside the

3-mile limit constitute the high seas, the United States could take no action based on Panama's claim to jurisdiction over them; and as the rights of Panama in the event a future permanent delimitation of the Zone should place Manzanillo Bay in Panama could be adjusted at that time, without, in the meantime, any injury to Panama's interests, the landing of the cable was permitted, and it is now in operation.

Transportation of Panama prisoners through the Canal Zone. It is necessary for the Panama Government, in transporting prisoners between Panama and Colon, to send them through the Canal Zone, in charge of police officers. It has been the practice of the secretary of foreign affairs of Panama to notify the executive office in each case of the necessity of sending prisoners through the Zone. To such notices it has been customary to reply that authority is granted for the police of Panama to transport the prisoners through the Zone.

Recently the secretary of foreign affairs of Panama called attention to the wording of these replies, stating that the Canal Zone authorities are notified of the transit of prisoners of the Republic through the Zone in order that they may know that the prisoners are not in the enjoyment of their liberty, and may render assistance to the police of Panama in charge of the prisoners in the event of necessity, and that the wording of these replies, if continued, might injure the rights reserved by the Republic in Article VI of the treaty.

Assuming that the secretary referred to the provision of Article VI, that the grants contained in the treaty should not interfere with the rights of way over the public roads passing through the Zone, I advised him that I understood that this provision was intended to secure unrestricted passage to all persons over the public roads of the Zone where such passage would not conflict with the rights granted to the United States; but that I did not understand that it was intended to reserve, in police officers of Panama, the right to exercise their functions on such roads. No further communication on the subject has been received.

Panama street railway.—In April, 1905, the municipal council of Panama advertised for bids for a franchise to build and operate a street railroad in that city. Mr. Henry T. Cook was the successful bidder. His bid was accepted by the municipal council March 13, 1906, and a contract, under the terms of the franchise, was entered into by him with the municipal council of Panama on October 31, 1906. The contract authorized him to construct and operate, upon certain specified streets in the city of Panama, a street railroad, and also upon other streets at such times as the traffic might require it.

Under the contract Mr. Cook was required to keep in good condition the part of the street between the two rails of the track and 2 feet on either side of the track. He was also required to deposit in the municipal treasury \$5,000, or negotiable securities of the value of \$10,000, to guarantee the fulfillment of the contract.

As the Canal Commission had paved the streets of Panama as a sanitary measure, and no arrangement had been made to reimburse the United States for the expenditure incurred, it had an interest in the pavements, and Mr. Cook opened negotiations with the Commission for the purpose of securing its permission for the construction of the railroad through the streets paved by the Commission. He was informed by the chairman of the Commission that the Commis-

sion would consent to his constructing the railroad through the paved streets upon his filing a bond in the sum of \$25,000, conditioned upon the proper repair and maintenance of the streets. Mr. Cook declined to do this and commenced the construction of tracks, first upon an unpaved street and subsequently upon a paved street. When he commenced to tear up a paved street the attention of the Panama Government was called to the fact, and that Government was requested to enforce the provisions of a decree published by it May 25, 1906, at the instance of the Commission, providing that no person shall excavate any paved or macadamized street for any purpose whatever without first filing an application for permission to do so and making a cash deposit to cover the estimated cost of taking up the paving or macadam, refilling the excavation, and replacing the pavement or macadam in its original condition. The amount of the bond requested of Mr. Cook by the Commission —\$25,000—was the estimated cost of this work, which would be made necessary by the construction of the railroad on paved streets. The Panama Government enforced the decree and work on the railroad has been discontinued.

Mr. Cook has made several requests for permission to construct an electric railroad in the Canal Zone to be operated in conjunction with the railroad to be constructed in Panama. The Commission has recommended a revocable license for the construction of this railroad, providing Mr. Cook is able to satisfy the Secretary of War of his financial ability to do the work. No action has been taken by the Secretary up to the present time.

Waterworks, sewers, and pavements in Panama and Colon.—Under the canal treaty the United States was authorized to construct waterworks and sewers as sanitary measures and to perform other sanitary work in the cities of Panama and Colon. The treaty provided that—

all such works of sanitation, collection and disposition of sewage, and distribution of water in the cities of Panama and Colon shall be made at the expense of the United States, and the Government of the United States, its agents or nominees, shall be authorized to impose and collect water rates and sewerage rates which shall be sufficient to provide for the payment of interest and the amortization of the principal of the cost of said works within a period of fifty years.

Shortly after the work of installing water and sewer mains was undertaken in Panama the Panama Government requested the construction at the same time of pavements upon the streets of the city, suggesting that the United States should reimburse itself for the cost of paying by water rates, as provided by the treaty.

In 1905 the work of paying the cities was undertaken by the Commission as a sanitary measure. As it neared completion, during the past year, the question of the reimbursement of the United States for the expenses incurred was suggested to Panama, and that Government repeated the desire that the United States should reimburse itself for the cost of the paying by increasing the water rate. The rate has therefore been fixed at 25 cents per thousand gallons, instead of 15 cents as heretofore.

The same arrangement has been made with reference to the cost of pavements in Colon—the rate there to be 40 cents, as at present. The increase in the consumption of water in Colon makes it possible to raise the necessary amount of money within fifty years without charging a higher rate than that.

Contracts with Panama on the subject of the Panama and Colon water rates are now pending and will be closed within a short time.

Street cleaning in Panama and Colon.—Among other sanitary works, the Government has been sweeping the streets of Panama and Colon and removing garbage therefrom. Negotiations have been in progress for some time for the transfer of this work to the Panama Government, and it will be transferred September 1, 1907.

Importations by employees.—Under the Executive orders of December 3, 1904, and January 7, 1905, respecting imports into the Canal Zone, which were agreed to by Panama, employees of the Commission are authorized to bring in, free of duty, articles for their personal use.

In order to facilitate the shipment of these articles and to reduce as much as possible the trouble of handling them, an agreement was made with Panama for the use of a form of declaration to be made out by an employee and sent to the head of this department. Copies of the declaration are forwarded by the head of the department to the secretary of the treasury of Panama, the general manager of the Panama Railroad Company in Colon, as his authority for delivering the shipment, upon its receipt, without the collection of duty upon it, and the New York office of the railroad for use there in making up the ship's manifest. This system has worked satisfactorily.

During the fiscal year 436 requests for free admission of shipments of employees were received and approved.

Delimitation of the Canal Zone.—The treaty provides that the Canal Zone shall extend from the 3-mile limit in the Atlantic Ocean to the 3-mile limit in the Pacific Ocean and to the distance of 5 miles on either side of the center line of the canal. By the agreement entered into by General Davis, then governor of the Canal Zone, and representatives of the Panama Government, on June 15, 1904, the limits of the Zone were provisionally determined with reference to the center line of the sea-level canal projected by the French canal company. In a few localities, where it became necessary in order to settle questions pending, the provisional limits were located and marked, by joint action of the Zone authorities and Panama. When the center line of the lock canal to be built by the United States was located it became possible to determine and locate the permanent boundary lines of the Zone. Maps were therefore prepared by the Canal Commission showing the proposed permanent boundary lines, and were submitted to the Panama Government, which accepted them. Joint parties under the direction of engineers representing Panama and the United States, were put in the field for the purpose of locating the lines as shown on these maps. The lines which have now been located consist of a succession of tangents instead of curves, as did the provisional boundary lines. It is proposed to mark them by concrete monuments at the intersection of the tangents and by monuments of iron pipe at points where the boundaries intersect streams and roads.

The provisional boundaries of the cities and harbors of Panama and Colon, which are excepted from the Canal Zone by the canal treaty, are still observed. It is hoped that within a short time it will be possible to agree with Panama upon the permanent boundary lines of these cities and harbors, thus closing up the entire question of boundaries.

Extradition.—Under the extradition arrangement with Panama, reported in the last annual report of the governor of the Canal Zone, 34 requests have been made by the Zone authorities for extradition from Panama to the Zone, and 15 requests by the Panama authorities for extradition from the Zone to Panama. In many cases it has been impossible to locate the persons whose extradition has been requested. The arrangement has worked satisfactorily.

Extradition to other countries than Panama.—In May the American minister at Panama notified the Zone authorities that he had been requested by the American minister at Quito to have detained an American wanted in Ecuador for the alleged embezzlement of funds of a railroad company. The American was arrested by the Zone police upon his arrival at La Boca. Through his attorney he sued out a writ of habeas corpus, and upon the hearing of the writ he was discharged on the ground, first, that the offense with which he was charged was not extraditable under the treaty of the United States with Ecuador, and, second, that the procedure required by the extradition laws of the United States had not been complied with.

While the point was not made at that hearing, I am of opinion that the extradition laws and treaties of the United States do not apply to the Canal Zone, and that there is no authority for the extradition from the Zone to any foreign country having an extradition treaty with the United States of fugitives from justice of such country. The extradition laws and treaties of the United States were extended to the Philippines by act of Congress, and it is believed that it would be advantageous to have them extended to the Canal Zone by Executive order.

DEPORTATIONS.

In the President's letter of instructions of May 9, 1904, addressed to the Secretary of War, he authorized the Commission to exclude and deport from the Canal Zone certain undesirable classes of persons. This authority was referred to in the last annual report of the governor of the Canal Zone.

By a resolution of the Commission adopted February 20, 1905, the authority to act for the Commission in executing this provision of the President's order was vested in the governor of the Canal Zone.

On January 21, 1907, the Commission passed a second resolution authorizing the manager of the department of labor, quarters, and subsistence to act for the Commission in the deportation of persons certified as chronically ill by the chief sanitary officer, and under date of April 24, 1907, it passed another resolution, which is as follows:

Resolved by the Isthmian Canal Commission. That the chairman of said Commission is hereby directed to enforce the requirements of the foregoing Executive order, and is hereby authorized to exercise for and in behalf of said Commission the authority conferred upon the Commission and properly to be exercised by it under that portion of the President's instructions heretofore set forth.

Resolved. That the head of the department of labor, quarters, and subsistence is authorized to report these persons who are certified by the chief sanitary officer to be chronically ill, and to incur on behalf of the Commission the necessary expense incident to their deportation.

During the fiscal year 56 deportations were made by or on the recommendation of the head of this department. This number is in addition to the deportations on account of illness made under the resolutions of January 21 and April 24, 1907.

RELATIONS WITH FOREIGN CONSULS.

With the importation of laborers from European countries the consuls of those countries in Panama have shown considerable activity in their behalf, and the work of the executive office relating to them has materially increased.

Complaints made by the consuls usually fall into one of three classes: (1) Those relating to errors in adjusting accounts of the laborers; (2) those relating to their food and quarters, and (3) those relating to differences with foremen on the work.

Complaints of the first class are due in most cases to the inability of the laborers to speak or understand English and to their disposition to change constantly from one locality to another, often with a change of name.

Those of the second class, when they are well founded, are due to the inability of the Commission to get efficient servants for the messes and kitchens, delays in train service, and short or poor food supply.

Complaints of the third class have their origin almost invariably in the inability of the foremen and men to understand and speak with one another.

Few of the complaints involve questions of importance even to the laborers themselves, but they are often magnified in the minds of the men into serious grievances.

Conditions are constantly improving among European laborers, however, as they become more accustomed to life on the Isthmus, and more convinced of the purpose of the Commission to treat them fairly. It is believed that the solution of the situation lies in securing their full confidence. This can be accomplished most easily by appointing foremen over them who speak their language, and by investigating fully, fairly, and promptly every complaint they make. This investigation of complaints will now be made, under the chairman's direction, by the secretary of the Commission. It would be of great convenience generally, and would assist especially in making investigations, if a card record of the laborers were kept, similar to that kept of American employees.

Considerable activity was manifested on several occasions during the year by representatives of certain South American countries, and of companies operating in those countries, in recruiting labor on the Isthmus. Efforts on the Isthmus to dissuade these persons from carrying on their operations were in most cases unavailing. In a few instances persons under contract with the Commission to repay the cost of their transportation to the Isthmus were prevented, by ne exeat proceedings, from leaving, where it was possible to say that they were indebted to the United States. Little, however, was accomplished by this means, and the matter was referred to the Secretary of War by the chairman of the Commission, to be taken up by the State Department. Recruiting operations have now practically stopped. It is believed that this is the result not so much of any effort here to prevent them as of the fact that the laborers taken to South America have not found conditions satisfactory and have reported that fact to their friends upon the Isthmus.

OFFICE BUILDINGS.

It was decided several months ago to adapt the building under construction and originally intended for the residence of the governor of the Canal Zone for use as a general office building. It is hoped that by the 1st of January, 1908, it will be possible to remove into it all of the general offices of this department except those of the chief of the fire department and superintendent of public works. While it is desirable that the offices of this department should be near Panama, to facilitate communication with officials of the Panama Government, yet it is equally desirable that they should be located in Canal Zone territory.

It has been suggested that the present administration building in Panama, where the offices of the department now are, should be sold. This may be possible eventually, but for the time being it will be necessary to retain the building for use as offices that for the sake of convenience should be located in the city of Panama.

The removal of the disbursing office back to Panama was suggested, on account of the greater convenience of having the office here in conducting negotiations with local bankers. It has been determined, however, to be inadvisable to make the change, on account of the fact that the jurisdiction of the Zone authorities does not extend to the building and they would therefore be unable to afford proper protection to funds in the building.

At Cristobal the local offices of this department will be brought together shortly in one of the "De Lesseps palaces" now being remodeled for use as an office building.

DEPARTMENT OF REVENUES.

The department of revenues, which is under the direction of the collector of revenues, includes the divisions of posts, customs, revenues, lands and buildings, and administration of estates.

Division of posts - There are now 16 post-offices in the Canal Zone, located at the following towns:

La Bora	Las Obispo	Ancon	Matachin.
Copozal	Gorgona.	Pedro Miguel	Tabernilla.
Paraiso	San Pablo	Culebra	Bohio
Empire.	Gatun	Las Cascadas	Cristobal.

A post-office, designated as "Ancon, Station A," is also maintained in the administration building in the city of Panama, exclusively for the convenience of the officers and employees of the Commission located in that building.

The growth of the postal business has been constant, and almost without exception each month's business has shown an increase over that of the preceding month. The postage sales during the month of July, 1906, were \$4,417.06, and the net amount accruing to the Zone government from postage sales, after deducting 40 per cent of the face value of the stamps (paid the Panama Government), was \$2,650.24. In April, 1907, the postage sales were \$5,115.70; May, \$6,442.54, and in June, \$4,817.64.

As stated in previous reports, the gross receipts of the post-offices do not indicate the amount of mail matter handled. It has been

estimated that 75 per cent of the mail is handled under Government frank, from which, of course, the post-offices derive no revenue. It is believed that if the postal division were credited with regular rates of postage for mail handled under Government frank, as is done generally when one department of the Commission performs work for another, the postal division would not only be self-supporting, but a large profit, considerably in excess of the present postal revenues, would result. At the present time, if the postal division requires any printing the division of material and supplies performs the work, charging the postal division for the cost of material and labor, plus 20 per cent; yet that division distributes a large part of the output of the Commission's printing office under Government frank, and the postal division receives no credit for handling and delivering it.

During the year ended June 30, 108 dispatches of mail were made to New York, 28 to New Orleans, 32 to Trinidad, 49 to Jamaica, 34 to Barbados, 14 to Bordeaux, France, and the French West Indies, and 16 to Port Limon.

The growth of the registry business has kept pace with the growth of the postal business generally. The registry business increased 30 per cent during the last six months of the fiscal year over the first six months of the year. About 40 per cent of the registry business handled is under Government frank, practically all papers relating to timekeeping and the disbursement of funds being passed between the disbursing office and the different departments by registered mail. A statement is attached showing the extent of the registry business for the fiscal year ended June 30, 1907.

The money-order system of the Canal Zone was organized June 1, 1906, and has therefore been in operation thirteen months. During the month of June, 1906, 1,611 money orders were sold, aggregating \$50,067.15; in June, 1907, 9,532 money orders were sold, aggregating \$281,415.31. With one exception the money-order business has shown an increase from month to month. The statement accompanying this report shows the number and amount of money orders sold, the amounts drawn on points in the Canal Zone, and the amounts drawn on the United States and foreign countries. Outside the cities of Panama and Colon there are no banking facilities on the Isthmus, and employees of the Commission stationed at points on the line of the canal frequently purchase money orders to secure a safe depository for their funds. The amount of money orders paid in the Canal Zone has, during each month, been less than the amount of those purchased for payment in the Zone, and the difference probably represents the savings of employees. Efforts have been made to advertise by circular and otherwise the money-order system among the European laborers imported by the Commission, in order that they may avoid the payment of large rates of exchange. The fee for an order of \$100 issued in the Canal Zone for payment in Italy is \$1.33, which is considerably less than the usual banking rate of exchange.

The work accomplished by the postal division has been performed at times under great difficulties. The present personnel is numerically inadequate, and efforts have been made to supplement it by transfers from the postal service of the United States. The desire is to have in the post-offices of the Canal Zone only persons trained in

post-office work in the United States. It has not been possible, however, to secure the necessary number of such persons, but as the Civil Service Commission at Washington has recently approved the transfer of several experienced clerks it is hoped soon to bring the force up to the required number.

There are at the present time seven post-office buildings in use which were built by the Canal Commission especially for that purpose, located at the following points: La Boca, Pedro Miguel, Culebra, Empire, Gorgona, Las Cascadas, and Gatun.

Buildings built for other purposes have been repaired and adapted to post-office work at the following points: Ancon, Corozal, Paraiso, Matachin, Bas Obispo, San Pablo, Bohio, Tabernilla, and Cristobal; and plans are in preparation for the construction of a large modern post-office building at Cristobal, the exchange office of the Canal Zone, as the building now occupied there does not meet the present requirements.

Division of customs - There are two customs districts and two ports of entry in the Canal Zone - Ancon on the Pacific side and Cristobal on the Atlantic side - created, respectively, by Presidential orders of June 4 and December 3, 1904.

Practically all of the vessels arriving at the Isthmus on the Pacific side now enter the port of Ancon. At the port of Cristobal there were no docking or terminal facilities when that port was opened, but there have since been constructed docks equipped with modern appliances, and the railroad has extended the necessary tracks. The vessels of the Panama Railroad Steamship Line, and many others which formerly cleared for the port of Colon and entered Cristobal by clearance from Colon, now clear from port of first departure direct for Cristobal.

During the year ended June 30, 116 vessels, of a gross tonnage of 203,147 tons, entered the port of Cristobal, and 113 vessels, of a gross tonnage of 196,817 tons, cleared from that port. At Ancon 163 vessels, of a gross tonnage of 274,656 tons, entered, and 162 vessels, of a gross tonnage of 274,870 tons, cleared from that port.

Under the Executive order of the Secretary of War, issued by direction of the President on December 3, 1904, no duties, tolls, or fees of any kind are charged for services rendered vessels entering and clearing at the ports of the Canal Zone, and all duties on commercial cargoes arriving at the ports of the Canal Zone not consigned to the Commission or the Panama Railroad Company, and intended for consumption in the Republic of Panama, are collected by the customs authorities of that Government, notices of such shipments with manifest and invoice values being transmitted by the customs authorities of the Zone in order that collections by the Republic of Panama may be safeguarded.

The customs service of the Zone, therefore, produces no revenue, the duties of the collector being confined to entering and clearing vessels, filing manifests, recording protests, and the usual services to seamen. The customs authorities of the Zone also enforces the laws of the Republic of Panama against smuggling and the immigration of Chinese, Syrians, and Turks into the Canal Zone.

Revenues.—The sources of revenues described in the act of the Commission creating the internal-revenue service are "such taxes, imposts, dues, fees, fines, and penalties as shall be authorized and required by the laws of the United States applicable to the Canal Zone and by the enactments of the Isthmian Canal Commission."

The act also provided that the Internal-Revenue Service "shall be regulated and controlled in like manner and extent as is prescribed by the laws, rules, and regulations of the Internal-Revenue Service in the United States, not inapplicable to the conditions of law and fact existing in the Canal Zone."

No law has yet been enacted fixing the rates of taxes on distilleries, nor any rules or regulations prescribed for measurement or operation of stills in the Canal Zone, and the law of Panama in force on February 26, 1904, governing the licensing and operation of distilleries is observed and enforced. The distillation tax is \$6 (Panama currency) per liter capacity per month of thirty working days, for a continuous apparatus, and \$3 (Panama currency) per liter capacity per month of thirty working days, for a simple apparatus. Distillation licenses to the amount of \$5,189.95 were collected during the year ended June 30, 1907.

The order of the President abolishing the municipalities provided that the collector of revenues shall have charge of the collection of taxes and licenses and all other forms of collections previously made by the municipalities, and on April 15, 1907, there was added to the personnel of the revenue department a force of four district tax collectors, one for each district, and five assistants, two assistants being assigned to the most populous district.

Division of lands and buildings.—This division has charge of the leasing of building lots and agricultural lands and buildings owned by the United States which are not required for Commission purposes.

The number of agricultural leases during the year has decreased, instead of increasing, as was expected. The reason for this is not apparent, unless it is that the returns from agricultural ventures are slow and require an amount of capital which the smaller investor who would engage in independent agricultural pursuits in the Tropics is not prepared to furnish, doubtless it is also partly due to the fact that remunerative employment can always be secured on the canal work. The reduction in the number of leases has been due to some extent to the cancellation of leases on watersheds draining into reservoirs which furnish the water supply for towns and villages on the Isthmus. Three watersheds have been entirely cleared of human habitation and no leases are now made in the vicinity of reservoirs without reference to the sanitary department for approval as to location.

During the past dry season a number of roads and trails were opened in the administrative districts of Ancon, Emperador, and Gorgona, and there is every reason to believe that the number of agricultural leases will increase during the present year, as there is now available a large amount of valuable agricultural land which has hitherto been inaccessible. The total number of leases for building lots in force on June 30, 1907, was 479, and for agricultural lands 83, the leases for agricultural lands covering 344 hectares of land.

As stated in the first annual report of the governor of the Canal Zone, about 52 square miles of land in the Zone were purchased by the United States from the New Panama Canal Company, and about 189 square miles were acquired from Panama under the treaty. Much of this land will be required for canal construction purposes, and a large part of it will be submerged by the lakes formed by the canal.

The authority for leasing this land is found in the act of Congress approved July 28, 1892, authorizing the Secretary of War to lease,

for a period not exceeding five years and revocable at any time, property of the United States under his control and not required for public use.

The land laws of the United States do not apply to the Canal Zone, and the land laws of Panama in force in the Zone at the time of its cession to the United States are not applicable to the conditions in the Zone. It is believed that as soon as it is possible to determine with reasonable certainty the lands that will be required for canal purposes on the Isthmus, the remaining lands should be opened to cultivation and settlement under some arrangement that will assure permanent tenure to persons desiring to secure it. A great deal of public land in the Zone is occupied by squatters, who have been on the land for many years without legal right. These persons are not disturbed, except where their occupation of the land interferes with canal work.

Considerable land in the Zone claimed by private persons is, it is believed, actually public land. As it becomes necessary from time to time to occupy it for public purposes the titles to such land will be adjudicated in the courts. The new code of civil procedure provides a simple method of testing titles in such cases.

Administration of estates.—Under act No. 24 of the Isthmian Canal Commission the collector of revenues is ex officio administrator of estates for the Canal Zone where the decedents were citizens of the United States and employees of the Isthmian Canal Commission or the government of the Canal Zone and the estates consist entirely of personal property not exceeding in value \$500 United States currency. Twenty-nine estates were settled during the year ended June 30, 1907.

By an Executive order dated June 22, 1907, the Secretary of War extended the provisions of act No. 24 to include employees of the Panama Railroad Company.

It is but just to say that the administration of the various branches of the department of revenues, including posts, customs, revenues, lands and buildings, and the administration of estates has been eminently satisfactory and efficient.

MUNICIPALITIES

By legislative action of the Canal Commission in September, 1904, the Zone was divided into five municipal districts, and a local municipal organization was provided for each district. While the officials of those municipalities were appointed by the governor, it was the purpose of the law to have them in as large a measure as possible self-governing. However, very few of the more intelligent citizens of Panama on the Isthmus live outside of the cities of Panama and Colon, and Americans and others, not citizens of Panama, living in the Zone, are almost without exception employed by the Canal Commission. From these conditions there developed the practice of appointing Americans to municipal positions and sending them into the various municipalities of the Zone to perform their duties. This left little of the original element of self-government existing in the municipalities, and it was considered better that, as they could not be made in any substantial manner self-governing, their authority should be vested in the central government of the Zone. In many respects the municipalities were a distinct advantage in solving the problem of government. Especially was this so in the relations of the municipal officials

to the native inhabitants of the Zone, who had been accustomed always to bring the most trivial incidents of their lives to the local officials for adjustment. The removal of the municipal officials would have been a distinct hardship to those people but for the fact that in every district municipal officials were continued as officers of the Zone in the organization created when the municipalities were abolished. But, notwithstanding that fact, the people constantly bring their grievances and complaints to the executive office.

When the municipalities were abolished the collection of taxes previously collected by them was turned over to district tax collectors, reporting to the collector of revenues, district judges were provided for in place of the municipal judges, and the Commission was given authority to enact ordinances on subjects on which the municipal councils had previously legislated.

While the municipal governments were very satisfactory, yet it is believed that the present form of government, with administrative districts, will prove more so when it has been in operation sufficiently long to enable the officers of the government and others to become familiar with its form and powers.

Immediately after the signing of the order reorganizing the Canal Commission, on November 17, 1906 (which provided for the separation of the department of government from the department of sanitation), and the appointment of the head of the department of law and government, plans were made for the abolishment of the municipalities; but the required Executive order of the President was not signed until March 13, 1907, and did not become operative until April 15, 1907. During the period November 22, 1906, to April 15, 1907, the activities of the municipalities were confined to the routine matters and the enactment of the necessary appropriation ordinances. The construction of roads and trails, for which work there was on hand in each of the municipal treasuries a considerable balance, was carried on under the direction of the superintendent of public works.

ZONE FUNDS.

The abolishment of the municipalities of the Zone and the provisions in the act of Congress of March 4, 1907, respecting the use of Zone funds, have given rise to some difficulties along this line. The officers of the municipalities collected and disbursed municipal funds; for the purpose of safe-keeping they were authorized to deposit surplus funds with the Zone treasurer. There had always been certain Zone funds in addition to the municipal funds, which had been held and accounted for by the Zone treasurer. Those included internal-revenue taxes, supreme court costs, and circuit court costs and fines, postal revenues, etc. From them the Secretary of War authorized the payment of the expenses of the school system of the Zone and certain miscellaneous and contingent expenses. The act of Congress of March 4, 1907, authorized and directed the use of money collected in the Zone and in the cities of Panama and Colon, by the Zone government, from the rental of lands and buildings, the postal service, court costs and fines, and taxation, to be used (1) for the creation of a miscellaneous and contingent fund for the Zone of \$10,000; (2) for public works and schools of the Zone, and (3) for the postal service the postal revenues alone, however, to be applied to that service.

This provision of the act of March 4 and the provisions of the Executive order of March 13 abolishing the municipalities resulted in the following classes of Zone funds:

- (1) Municipal funds on hand March 4.
- (2) General Zone funds on hand March 4.
- (3) Municipal funds collected between March 4 and April 14, inclusive, and all other general Zone funds collected on and after March 4.
- (4) Postal funds on and after March 4.

From the funds of the first class were paid all municipal expenses incurred up to March 4, and all municipal expenses, except those incurred for public work, from March 4 to April 14, inclusive, the balance of those funds being held subject to appropriation by the Commission for such purposes as the fund could have been used for by the municipalities before they were abolished.

From the funds of the second class were paid the expenses of the school system and miscellaneous and contingent expenses of the Zone government up to March 4, under allotments made for those purposes by the Secretary of War, the balance of those funds being held subject to appropriation by the Commission for Zone purposes, upon approval of the Secretary of War.

The funds of the third class can be used by the Commission only for public work, schools, and contingent expenses, and the funds of the fourth class can be used by the Commission only toward defraying the expenses of the postal service.

As a treasurer of the Zone has not yet been appointed, the disbursing officer of the Commission acts as treasurer for the Canal Zone under the laws of the Zone.

The Commission's auditor on the Isthmus audits the accounts of the Canal Zone, and for that purpose exercises with reference to those accounts the authority of the Auditors and Comptroller of the Treasury.

COURTS.

Figures showing the number of cases tried in the various courts of the Zone during the year are included in Appendix 3.

Among the decisions of importance rendered by the supreme court during the year was the decision in the Coulson case, in which the defendant was convicted in the circuit court of the second circuit of murder and sentenced to death.

The laws of the Canal Zone provide that—

In cases wherein the penalty of death or imprisonment for life may be inflicted the circuit judge of the court wherein the information is filed or the action is triable shall summon two municipal judges of the judicial circuit to sit with him in the trial of said cause, and either or both of said municipal judges so summoned shall from any cause be unable to participate in said trial or shall be excused therefrom by the circuit judge, the circuit judge shall summon one or two, as the emergency may require, of the mayors of municipalities in said circuit to sit with him in the trial of said cause, if from incapacity, inability, or other good and sufficient reason, two of the officers above named cannot be secured to sit with the circuit judge in the trial of said case, the circuit judge shall summon one or two, as the emergency may require, of the disinterested and otherwise well qualified residents of the judicial circuit to sit with him in the trial of said case.

They provide, further, that the persons so selected shall participate with the circuit judge in the hearing and determination of questions and issues of fact. The circuit judge and each of such persons

have one vote on such questions. The concurrence of any two is decisive of the question passed upon. The circuit judge determines questions of law.

Coulson's attorneys moved for a trial by jury, as a right guaranteed by the Constitution of the United States. The court denied the motion, and an appeal was taken from the verdict of guilty to the supreme court of the Zone, which affirmed the decision of the circuit court. Coulson's attorneys, it is understood, propose to attempt to have the question of the legality of his conviction passed on by the Supreme Court of the United States.

The decision of the supreme court in the Andrade case was also important. That was a case of ejectment, brought in the name of the United States against Andrade, to recover possession of lands occupied by him. The Government claimed that the lands were at the time of the signing of the canal treaty public lands of Panama, and were acquired by it under the treaty. The defendant, who was in possession of the lands, pleaded the statute of limitations, and argued that the Government must prove its title to the land.

The court held that the statute of limitations does not run against the Government, and that the burden is always upon a person claiming adversely to the Government to prove title. The importance of this decision lies in the fact that a great deal of land in the Zone supposed to be public land is claimed by private persons. The case was tried and the decision rendered under the code of civil procedure of Panama in force at that time in the Canal Zone. The new code of civil procedure, which was not then in force, provides specifically for the rights of the Government as they were held by the court under the former code of civil procedure.

The number of cases in the circuit courts tried during the year was considerably larger than the number for the preceding year, especially on the criminal side.

Additional duties were placed upon the clerks of the circuit courts by the executive orders respecting marriage and the registration of land titles.

The municipal courts were abolished by the order of March 13, which provided for the appointment of district judges to exercise the authority and discharge the duties of the municipal judges.

The duties of these district judges are very important. They try from 500 to 600 criminal cases a month, and upon them depends in a large measure the enforcement of law in the Zone. They combine the functions of a country justice of the peace in the United States with those of a city recorder. The dignity and responsibility of the office and its importance in the scheme of government provided for the Zone are being recognized more and more as time goes on.

POLICE DEPARTMENT.

In addition to his duties as head of the police department, the chief of police discharges the duties, by himself and through his subordinates, of marshal of the courts of the Zone, warden of the Zone penitentiary, and coroner of the Zone.

On July 1, 1906, the strength of the police department was 221 officers and men and 6 clerks, and on June 30, 1907, the force consisted of 181 officers and men and 7 clerks. Of the men on the force

on July 1, 1906, there were 59 white and 162 colored, and on June 30, 1907, 91 white and 90 colored. It was reduced from 245 members on October 31, 1906, to 171 on January 31, 1907.

There is appended to this report a statement, by months, of the force and pay rolls of the police department for the fiscal year 1906-7.

The importations by the Commission of European laborers for work on the canal soon made it necessary to increase the force. It was found necessary in handling European laborers to have a force composed largely of white officers, as the European laborer objects to control, correction, or arrest by colored policemen.

The enlisted force of the police department was composed during the year of the following ranks: Policeman, \$40 per month; first-class policeman, \$75 per month; corporal, \$80 per month; sergeant, \$100 per month; first-class sergeant, \$125 per month.

The policemen are negroes from the West Indies, and most of them have served in the constabularies maintained by the governments of the islands.

The position of first-class policeman is filled only by white officers. Almost all of them are American citizens who have had military experience.

The ranks of corporal, sergeant, and first-class sergeant are filled by promotion from the grade of first-class policeman.

The salary paid first-class policemen during the year was \$75 gold per month. This was found inadequate to maintain a permanent force of those officers, as salaries in other lines of work under the Commission are higher, and the police force continually lost competent police officers who resigned to accept employment in other departments of the Commission.

It was necessary during the year, in order to maintain the force of white officers, to include in the contract of employment with those brought from the United States, a clause providing that they should not be eligible to appointment in any other branch of the Commission's work on the Isthmus until they had completed one year's service in the police department. Effective August 1, a new scale of salaries, with increases, went into effect, and it is expected that it will remove many of the difficulties that have been experienced in keeping an efficient force.

The total number of arrests during the year ended June 30, 1907, was 6,236, as compared with 3,356 during the year ended June 30, 1906, an increase of 85.8 per cent. This increase is in part due to the large increase in population, but it is principally due to the change in the make-up of the population resulting from the importation of European laborers by the Commission. Of the arrests during the year ended June 30, 1907, 5,871 were males and 365 were females.

It would be a great assistance to the work of the department if sergeants in charge of stations were authorized to accept cash bail in misdemeanor cases, for the appearance of persons arrested, before district judges. This authority should not, however, apply to persons arrested on warrants issued by the district judge.

The large number of laborers of foreign nationalities brought to the Isthmus during the year gave rise to various new problems. In the main, the West Indian laborers are tractable and law-abiding, and have confidence in the ability and disposition of the Government to treat them fairly. These characteristics make the maintenance of

order among them comparatively easy. But the European laborers, restless, suspicious, and excitable, constitute a class very different in temperament and character from the West Indian laborers. The maintenance of order in the Zone became, with the influx of these people, more difficult.

Arrests for intoxication, disorderly conduct, fighting, and crimes of violence have continued to increase as the number of European laborers on the Isthmus has increased.

During the year ended June 30, 1907, ten stations and jails have been constructed and three lockups built for the police department. But four buildings which were adapted for temporary police use are now used as jails, their locations being La Boca, Corozal, Paraiso, and Bohio. All other jails and police stations in the Zone were constructed for police purposes, and have been erected since the organization of the government of the Canal Zone.

The work of the police department includes many duties not ordinarily assigned to a police force. Much of the work ordinarily performed by watchmen in connection with shops, warehouses, and other similar buildings is in charge of the police, and police guards are furnished for the disbursing officer, his paymasters and pay cars, and the passenger trains of the Panama Railroad Company.

Satisfactory relations have been maintained between the police departments of the Zone and of the Republic of Panama, and the departments have cooperated to reduce crime on the Isthmus to a minimum.

There were 45 convicts confined in the Zone penitentiary on July 1, 1906; 85 convicts have begun penitentiary sentences during the year ended June 30, 1907, and there were 82 convicts in confinement on June 30. Pardons were granted during the year to 5 convicts in the Zone penitentiary.

There are appended to this report six tables of statistics respecting the Zone penitentiary.

The work performed by the convicts has amounted to over 57 per cent of the cost of their maintenance.

The Culebra Jail has been used as a penitentiary since its completion, but, due to the crowded condition, it was necessary, in May of this year, to transfer all short-term prisoners from Culebra to the jail at Gorgona, pending the completion of an annex to the Culebra Jail, which will be used permanently as a penitentiary. The annex is now about 90 per cent completed.

In the discharge of his duties as marshal of the supreme and circuit courts, the chief of police reports that there have been 310 summonses, 663 subpoenas, and 4 executions served.

The chief of police, acting as coroner, has, during the year ended June 30, 1907, held inquests over 136 bodies. The most frequent cause of death resulted from railroad accidents, 58 being attributable to that cause; 28 deaths resulted from drowning.

When we consider the embarrassment that surrounded the organization of the Zone police force (the employment of both whites and blacks in nearly equal numbers; the fact that the white element was drawn largely from various sections of our own country, and that the second-class policemen consisted exclusively of a foreign element; that an organization had to be effected; that rules and regulations had to be adopted and put into practice; the liability of daily or

hourly impingement between the Zone police and those of the Republic of Panama in both the cities of Panama and Colon, and the difficulty, even the apparent impossibility, of avoiding clashes, and the overlapping of one jurisdiction by the police force of the other), the record furnishes the most conclusive evidence as to the capacity, tact, and efficiency with which this work has been accomplished.

FIRE DEPARTMENT.

The fire department was organized along the lines stated in the last annual report of the Commission. In November, 1906, a sufficient number of trained firemen from the United States had arrived to place in commission all the apparatus at Cristobal, which included a hose wagon, a chemical engine, a hook-and-ladder truck, and a steamer. In February of this year the building for the paid department at Ancon was completed and the apparatus, consisting of a combination chemical and hose wagon, carrying a 16-foot extension ladder, was installed. Paid firemen have also been stationed at La Boca, Culebra, Empire, and Gorgona. These men are in charge of the volunteers at their stations, and also inspect fire extinguishers, hose, and other apparatus.

The paid members of the fire department are men who have served as firemen in paid departments of the larger cities of the United States. Difficulty has been experienced in securing firemen from the United States, and the department is at present undermanned. The force of the department and its distribution on June 30, 1907, was as follows: Cristobal, chief of the department, 1 clerk, 10 firemen, 1 helper (laborer); Ancon, 5 firemen; Gorgona, 1 fireman; Culebra, 1 fireman; Empire, 1 fireman; La Boca, 1 fireman.

During the present year additional paid companies will be established at Ancon, Culebra, Empire, and Gorgona, and electric fire-alarm systems will be installed at all those places. Two fire stations have been constructed for paid departments—the one at Cristobal and the one at Ancon. Fire stations have been constructed at Gatun, Gorgona, Las Cascadas, Empire, Culebra, Paraiso, Pedro Miguel, Corozal, and La Boca for the use of the volunteer companies at these points.

The work of organizing and drilling volunteer companies has been pushed with energy, and those companies have rendered services of a high order on several occasions during the year. Organized volunteer companies of 20 members each are stationed at the following points: Ancon, 1 company; Gorgona, 2 companies; Empire, 2 companies; Culebra, 2 companies; La Boca, 2 companies; Paraiso, 1 company; Pedro Miguel, 1 company; Corozal, 1 company; Gatun, 1 company; Las Cascadas, 1 company; Matachin shops, 1 company; Tabernilla, 1 company.

The employees in Commission buildings of importance, such as the administration buildings at Culebra, Empire, and Panama, the Commission's hotels, including the Tivoli and the commissary at Cristobal, and in many smaller buildings, have been drilled in the use of the fire-fighting apparatus placed in those buildings, and in the protection of the records of the offices. It is hoped by this method, in the event of fire in any of the buildings, to hold it in check until the arrival of a paid or volunteer fire department.

There are no paid fire companies in the cities of Panama and Colon, and the fire protection of those cities is intrusted entirely to volunteer companies. It has been necessary on occasions during the past year, in order to protect Government property situated in those cities, for the Canal Zone fire department to assist the Panama and Colon volunteer companies.

A table is appended to this report showing the number of fires, by months, for the nine months ended June 30, the total losses resulting, and the amount of loss sustained by the Government. From this table it will be seen that one fire, that of the Mount Hope storehouse, on April 1, resulted in serious loss to the Government. Mount Hope is only a mile from Cristobal, but the fire department at Cristobal was delayed in reaching the fire because of the necessity of securing an engine and flat car to take the equipment there by rail. A wagon road from Cristobal to Mount Hope, at that time in progress, has since been completed, and the storehouse is now protected. The small loss resulting from the other fires is due to the fact that they were discovered in their incipency and were promptly extinguished by the use of chemical extinguishers. The chief of the fire department estimates that the total amount of property involved in all the fires occurring during the period named is \$1,300,000 United States currency.

The estimated cost of the fire department for the fiscal year ending June 30, 1908, is \$114,958.32. The cost of the new buildings constructed by the Commission to date is approximately \$8,255,837. Without including the cost of other buildings which were on the Zone when the work of canal construction was commenced, and without including the cost of materials protected, the rate of insurance, taking the cost of the department as the premium, would be 1.39 + per cent. This rate is reasonable, when compared with the insurance rates prevailing in most cities in the United States; the rates of insurance in the city of Panama are from 2 to 4 per cent and in the city of Colon from 6 to 8 per cent. In both cities higher rates than those named are charged for extremely dangerous risks. Another feature to be considered in insurance rates is the fact that all the buildings constructed by the Commission in the Zone, with a single exception, are frame buildings, of light construction.

In order to secure additional protection for the docks at Cristobal and Colon, turrett nozzles have been placed on two steam tugs belonging to the Panama Railroad Company and the Commission, and similar equipments will be installed on the steam tug *Bolívar* belonging to the railroad company, and used in the ports of Ancon and Panama.

A 10-box alarm system for Cristobal and vicinity has been installed and is kept in order by the electrician stationed at fire headquarters. Frequent tests are made.

Three-gallon chemical extinguishers have been placed in all buildings belonging to the Government. There are now 918 in use. These extinguishers are regularly inspected weekly at points where paid firemen are stationed and biweekly at other points. Hand grenades are also placed in Government buildings, and during the year ended June 30, 1907, 668 were distributed. Regular inspections of all Government buildings, including those under construction, are made by members of the fire department to see that inflammable matter is not

permitted to accumulate unduly or the risk of fire unnecessarily increased. In special cases inspections are made daily. The great freedom from fires in the Zone must be in some measure attributed to these inspections maintained by the fire department.

The value of the work of the fire department can never be accurately known, because the incipient or small fires are simply reported as small fires, with a loss of \$5 or \$10, when, but for the work of the department, they might have developed into large fires resulting in considerable loss and great inconvenience.

With the most efficient organization possible, however, and with every possible precaution, it is still to be expected that fires will occur.

PUBLIC WORKS.

When it was first proposed to turn over to the department of government the maintenance and operation of the Panama and Colon water and sewer systems, the position of water commissioner was created, to have charge of that work. In November, 1906, the position of superintendent of public works for the Zone was created, to include the duties of the water commissioner, and by the executive order of March 13, 1907, the superintendent of public works was given charge of the maintenance and operation of slaughterhouses, markets, and other public work in the Zone paid for from local funds.

The work of the superintendent of public works includes the maintenance and operation of the water and sewer systems and paving in the cities of Panama and Colon; the collection of water rents from private parties supplied with water from the water systems constructed for Commission purposes in the Zone; the inspection of plumbing in the Commission buildings in the Zone; the construction of roads and trails, and other public improvements in the Zone; the operation and maintenance of slaughterhouses and markets; supervision of street lighting in the villages of the Zone, and the maintenance of public buildings formerly used for municipal purposes and now used by the administrative district officials.

Operation and maintenance of water and sewer systems of the city of Panama—The water and sewer systems of Panama were turned over as completed to the superintendent of public works by the division of municipal engineering on March 1, 1907, repairs or work in connection with their maintenance previous to that time having been treated as a part of the work of installation and cared for by the division of municipal engineering. There has, of course, been very little work connected with the maintenance of the systems since March 1, and the work of the water commissioner has been almost entirely confined to their operation, including the letting of contracts for connection with the mains, the enforcement of plumbing regulations, and the collection of water rents. When the work of connecting houses with the mains was commenced considerable difficulty was experienced in keeping an accurate record of applications for connection with the mains, due to the fact that at that time almost every street in the city of Panama had more than one name, and few of the houses were numbered. A sectional map of the entire city was therefore prepared, showing the location of each house connection identified by a street name and house number, adopted by the division of municipal engineering, and by the contract number,

the contract number being also attached to the meter for each connection.

On October 1, 1906, a Venturi meter was installed for the purpose of measuring water coming into the city of Panama, and daily readings of this meter have been taken since. On December 1, 1906, meters had been installed on all private connections, and since that time the Panama government has been paying the regular rate for water used for public purposes, the amount consumed being ascertained by subtracting the total amount of water used for private purposes, as shown by the meters on private connections, from the total shown by the Venturi meter. For the seven months ended June 30, 1907, the government of Panama had paid \$4,486 20 United States currency net for water for public use. There are now 133 fire hydrants and 22 public taps for supplying water in the poorer districts of the city, a total of 155 street hydrants. The charge per hydrant per annum is therefore \$49.68, a reasonable charge when compared with the rates prevailing in the cities of similar size in the United States.

The work of connecting houses with the mains has progressed rapidly since the date of the last annual report. On October 31, 1906, there were 713 connections and 164 applications, and on June 30, 1907, there were 1,023 connections and 97 applications.

It has not been necessary to take legal action to secure the collection of any bills for water rents during the past year, and most of the bills have been paid before the expiration of the discount period of fifteen days. Attached to this report is a table showing the consumption of water and collection of water rents in the city of Panama for the fiscal year ended June 30, 1907. It appears from this table that the per capita consumption is considerably less than in any city of similar size in the United States. This is attributable in part to the fact that there are no factories and few steam plants in Panama.

It was not possible, due to delay in receipt of meters from the United States, to install them on all private connections until December, 1906. A considerable economy in the consumption of water resulted after meters had been placed on private connections, as is shown by a comparison of the average daily consumption for the months of October to June, inclusive:

Month	Average daily consumption	Connections	Number of connections metered
<i>Gallons</i>			
October 1906.	824,000	673	103
November	788,039	713	625
December	704,870	782	All
1907			
January	648,518	840	All
February	671,143	803	All
March	727,968	922	All
April	724,200	983	All
May	715,258	996	All
June	740,800	1,023	All

The water pressure in the city of Panama has at all times been satisfactory, and in case of fire it has amply met the requirements.

No work has yet been required in the maintenance of paving the city of Panama, and as there is no great amount of heavy traffic it is not expected that much work of this nature will be necessary other than that resulting from excavations in the streets for repairs to water and sewer mains.

Operation and maintenance of the water and sewer systems and street paving in Colon.—The water and sewer systems in Colon have not yet been turned over as completed to the water commissioner by the division of municipal engineering. The work of the water commissioner in that city has therefore been confined to the inspection of plumbing, the receiving of applications for service connections, and the collection of water rents. Although Colon has been supplied with water for more than a year, it was not possible, for want of sewers, to install plumbing in the houses there until March of this year. In March the installation of sewers had progressed sufficiently to begin the work of connecting the houses in a part of the city, and considerable progress has since been made. On December 31, 1906, there were 3 private connections paying water rent, and on June 30, 1907, there were 64. The net amount of bills rendered for the quarter ended June 30, 1907, was \$1,427.30 United States currency.

Zone water systems.—The water systems of the Zone are those which have been installed by the Commission for its use in connection with the construction of the canal. Water is also furnished to the houses owned by the Commission and occupied by Commission employees and to the hotels owned and operated by the Commission. Where it has been possible to do so, extensions to these systems have been made and water has been furnished to persons living in the towns in the Zone outside of Commission camps and quarters. As water is furnished without cost to employees of the Commission living in quarters furnished by the Commission, the work of the superintendent of public works in connection with the Zone water systems has been limited to the collection of water rents from private consumers. On June 30, 1907, there were 36 private connections, and 34 bills were rendered for that quarter, the net amount of the bills being \$484.45 United States currency.

Public improvements in the Zone.—During the dry season, extending from the latter part of December to the 1st of May, 37.31 miles of roads were constructed in the Zone. The character of the roads or trails varies with the territory through which they pass. The road from Culebra to Empire is a macadamized road, while the trails over the hills are usually but 6 or 8 feet wide, and are not passable for wheel traffic. The hilly nature of these sections makes it necessary, in handling agricultural products, to use pack animals, so that trails of this width answer every requirement.

The trails and roads constructed, briefly described, are as follows:

A 7-mile trail from the city of Panama into the Zone, following the old Cruces trail; a 5-mile trail from Pedro Miguel to Arraijan, a trail from Empire toward La Chorrera, in the Republic of Panama; a trail from Bas Obispo toward Cruces; a macadamized road from Culebra to Empire, and a trail from Empire to Gorgona, passing through the villages of Bas Obispo and Matachun.

Short connecting trails have also been built in the district of Ancon, and a 3-mile trail from Mount Hope to the interior of the district of Cristobal has been constructed.

There are 2 slaughterhouses under the direction of the superintendent of public works, located at Empire and Gorgona, and 3 markets, 1 each at Empire, Gorgona, and Cristobal. These properties are sources of considerable revenue to the Zone.

In order to take care of the increased slaughtering at Empire, a new slaughterhouse, farther from the village, is being constructed, and will be ready for occupancy by September 1 of this year.

The importance of the works described under this heading lies in the fact that they have been paid for entirely from funds raised by local taxation.

The work of construction of the Panama and Colon water and sewer systems and pavements will soon be completed, and in order to avoid the duplication of organization and duties it is proposed to confine the jurisdiction of the superintendent of public works to the work of inspection of water and plumbing in the Zone and the operation of slaughterhouses and markets; the actual construction work in connection with public improvements to be turned over to the engineering department, which is equipped for and is doing that class of work in connection with the construction of the canal. Under this division of duties the superintendent of public works will advise the head of the department of civil administration as to the most advantageous expenditure for local purposes of funds arising from local taxation. Request will then be made of the chairman for the execution of the work involved, which will be done, under the chairman's orders, by the engineering department.

SCHOOLS.

On December 1, 1906, the division of schools, which had been a part of the bureau of municipalities since May, 1906, was made an independent division. The average enrollment for the year was 1,643. The average attendance was 1,138—69 + per cent of the total enrollment. Schools were open during the year, or parts of the year, at the following points: La Boca, 4 rooms; Las Sabanas, 1; Pedro Miguel, 2; Paraiso, 1; Culcra, 3; Empire, 3; Las Cascadas, 1; Cruces, 1; Matachin, 2; Gorgona, 4; San Pablo, 2; Tabernilla, 1; Bohio, 3; Gatun, 2; Pleya de Flor, 1; Cristobal, 3; Chagres, 1; Frijoles, 1; Ahorea Lagarto, 1, and Cunette, 1 room.

The personnel of the division of schools on June 30, 1907, consisted of the superintendent, 1 clerk, and 31 teachers.

Considerable attention has been given by the Commission to the subject of schools in the Zone. New buildings have been authorized for white schools at Ancon, Las Cascadas, Paraiso, and Bas Obispo, and additions to the present school buildings at Gorgona, Empire, and Cristobal; and it is hoped that many, if not all of them, will be in condition for occupancy early in the coming school year.

The plan proposed and approved by the Commission contemplates the employment of teachers from the United States, of two grades, at salaries of \$90 and \$110 per month, respectively, for the schools to be provided for American and Panaman children; and for teachers from the West Indies at a salary of \$60 per month for the schools to be attended by the children of West Indian laborers.

Great difficulty has been experienced during the past year in securing proper quarters for women teachers from the United States, and

it is believed that this arrangement of teachers will in a large measure overcome that difficulty.

It is also proposed that the schools for American and Panaman children shall be organized into grades, with the pupils carefully classified, and that as far as conditions on the Isthmus will permit, facilities will be provided for the children of American employees here as broad in scope and purpose as are those of the schools in the United States.

During the past year 24 schools were opened. Of the buildings used 5 were constructed for school purposes by the Zone government; 14 schools were conducted in buildings repaired and adapted for school purposes, and 5 were conducted in buildings leased from private parties and adapted to school purposes.

• Conditions throughout the Zone government are very satisfactory. No changes have been made in the heads of divisions or other important officials since I assumed charge of the department. Most of the men in the department in important positions have been on the Isthmus for some time, several of them since the organization of the Zone government, and with a familiarity with the work and problems presented have developed an efficiency reflecting great credit on themselves and resulting in commendable work by their divisions.

Very respectfully,

JO. C. S. BLACKBURN,
Head of Department of Civil Administration.

The CHAIRMAN, ISTHMIAN CANAL COMMISSION,
Culebra.

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Month	Gold		Silver		Total employees.	Total salaries and wages.
	Monthly	Hourly	Monthly	Hourly		
July	51		22	22	416	\$34,704.65
August	87		29	21	437	35,615.41
September	86		21	21	444	37,781.80
October	110		27	28	463	37,693.84
November	116		24	21	463	37,964.78
December	111		2	14	458	31,253.76
January						
February	65		45	4	371	30,917.37
March	7		8	11	380	32,847.72
April	1		19	19	391	31,839.67
May	9		68	16	622	55,670.64
June	28		12	17	665	41,885.00
July	25			63	460	40,140.35
						427,227.08

TABLE 2.—*Executive office.*

Month.	Gold.		Silver.		Total employees.	Total salaries and wages.
	Monthly.	Hourly.	Monthly.	Hourly.		
1906.						
July.....	37	.....	6	18	61	\$8,292.27
August.....	38	.....	3	18	59	6,990.02
September.....	37	.....	4	16	57	6,294.22
October.....	33	.....	3	16	52	5,325.85
November.....	33	.....	.....	14	47	4,066.32
December.....	17	.....	.....	12	29	2,093.66
1907.						
January.....	16	.....	.....	10	26	2,117.10
February.....	15	.....	3	8	26	2,545.77
March.....	14	.....	2	.....	16	2,092.50
April.....	21	.....	3	.....	24	a 2,507.50
May.....	22	.....	3	.....	25	a 4,121.26
June.....	20	.....	3	.....	23	a 3,935.83
Total.....	.....	.....	.....	.....	.....	50,082.30

^a Includes district judges.TABLE 3.—*Bureau of municipalities.*^a

1906.						
July.....	33	.....	.....	.....	33	\$1,973.33
August.....	35	.....	.....	1	36	2,819.81
September.....	35	.....	.....	1	36	3,003.17
October.....	38	.....	.....	1	39	3,070.20
November.....	41	.....	.....	1	42	3,442.89
December.....	2	.....	.....	.....	2	367.50
1907.						
January.....	2	.....	.....	.....	2	198.33
February.....	.....	.....	.....	.....	.....	.....
March.....	.....	.....	.....	.....	.....	.....
April.....	.....	.....	.....	.....	.....	.....
May.....	.....	.....	.....	.....	.....	.....
June.....	.....	.....	.....	.....	.....	.....
Total.....	.....	.....	.....	.....	.....	14,065.23

^a Discontinued in January.TABLE 4.—*Division of schools.*^a

1906.						
July.....	.....	.....	.....	.....	.....	.....
August.....	.....	.....	.....	.....	.....	.....
September.....	.....	.....	.....	.....	.....	.....
October.....	.....	.....	.....	.....	.....	.....
November.....	.....	.....	.....	.....	.....	.....
December.....	37	.....	2	1	40	\$2,798.37
1907.						
January.....	32	.....	13	.....	45	2,558.35
February.....	31	.....	11	.....	42	2,477.74
March.....	32	.....	3	.....	35	2,423.34
April.....	33	.....	3	.....	36	2,466.66
May.....	33	.....	3	.....	36	2,513.83
June.....	32	.....	2	.....	34	2,445.60
Total.....	.....	.....	.....	.....	.....	17,683.80

^a Separated December 1, 1906, from bureau of municipalities.

TABLE 5.—Fire department.

Month.	Gold.		Silver.		Total employees.	Total salaries and wages.
	Monthly.	Hourly	Monthly.	Hourly		
1906.						
July.....	2				2	\$312 31
August.....	2		3		5	251 63
September.....	5		3		8	336 47
October.....	10		3		13	1,429 32
November.....	13		3		16	1,539 14
December.....	19			1	20	2,381 06
1907.						
January....	18			1	19	2,214 23
February....	18			1	19	2,051 01
March.....	18			1	19	2,082 34
April.....	16			1	17	1,898 17
May.....	19			1	20	2,213 14
June.....	21			1	22	2,712 50
Total						19,381 36

TABLE 6.—Legal department.

1906.						
July.....	3				3	\$710 41
August.....	4				4	801 03
September.....	5				5	1,250 00
October.....	5				5	1,064 33
November.....	4				4	1,004 06
December.....	3				3	741 00
1907.						
January.....	3				3	712 33
February.....	3				3	1,342 71
March.....	3				3	721 34
April.....	4				4	788 18
May.....	5				5	938 14
June.....	5				5	925 00
Total.....						13,887 19

TABLE 7.—Judiciary department.

1906.						
July.....	9				9	\$1,254 19
August.....	9				9	1,254 19
September.....	9				9	1,254 19
October.....	10				10	1,254 19
November.....	10				10	1,254 19
December.....	9				9	1,254 19
1907.						
January.....	9				9	1,254 19
February.....	10				10	1,254 19
March.....	10				10	1,254 19
April.....	10				10	1,254 19
May.....	10				10	1,254 19
June.....	11				11	1,254 19
Total.....						12,541 90

TABLE 8.—*Police department.*

Month.	Gold.		Silver.		Total employees.	Total salaries and wages.
	Monthly.	Hourly	Monthly.	Hourly		
1906.						
July.....	227	.....	.....	.....	227	\$12,325.86
August.....	241	.....	1	.....	242	13,067.49
September.....	239	.....	1	.....	240	13,527.43
October.....	245	.....	.....	.....	245	14,629.22
November.....	242	.....	.....	.....	242	14,427.27
December.....	262	.....	.....	.....	262	10,948.00
1907.						
January.....	171	.....	.....	.....	171	10,761.26
February.....	185	.....	.....	.....	185	11,750.54
March.....	198	.....	.....	.....	198	12,485.78
April.....	199	.....	.....	.....	199	12,429.26
May.....	188	.....	.....	.....	188	12,506.29
June.....	184	.....	.....	.....	184	11,855.20
Total.....	.....	.....	.....	.....	.....	150,713.60

TABLE 9.—*Revenue department.*

1906.						
July.....	53		17	4	74	\$7,422.19
August.....	51		19	4	74	7,783.78
September.....	55		19	6	80	8,093.19
October.....	61		19	10	90	8,418.05
November.....	62		20	8	90	8,769.55
December.....	62		20		82	8,135.28
1907.						
January.....	59		21		80	8,350.90
February.....	56		21		77	8,233.76
March.....	55		23		78	7,448.08
April.....	60		25		85	7,273.00
May.....	64		25		89	9,883.75
June.....	65		25		90	8,833.65
Total.....						98,645.18

TABLE 10.—*Division of public works.^a*

1906.						
July.....	7				7	\$1,142.71
August.....	7	1			8	1,247.33
September.....	8	1			9	1,502.51
October.....	8		1		9	1,120.41
November.....	9		1		10	1,782.17
December.....	10		1		11	1,576.68
1907.						
January.....	12		1	3	16	1,750.23
February.....	13		1	4	18	2,063.56
March.....	13		1	18	32	2,280.34
April.....	20		35	192	247	6,200.34
May.....	19		19	256	294	8,074.71
June.....	19		19	62	100	6,847.01
Total.....						35,588.00

^a Previous to December 1, 1906, office of water commissioner.

APPENDIX 2.—DEPARTMENTS OF REVENUES.

TABLE 11.—*List of letters and parcels registered in the post-offices of the Canal Zone from July 1, 1906, to June 30, 1907.*

Name of post-office.	Domestic letters registered.	Domestic parcels registered.	Foreign letters registered.	Foreign parcels registered.	Letters and parcels registered free.	Total.
Ancon ..	2,362	447	3,363	44	2,433	9,042
Ancon Station A.	1,736	153	791	25	10,000	122,214
Bas Obispo.	471	121	1,179	81	1,626	3,428
Bohio ..	96	6	215	1	254	578
Cristobal	4,177	742	4,763	47	2,129	11,858
Culebra ..	2,187	582	3,282	29	2,467	8,487
Corozal	247	61	396	20	932	1,636
Empire	1,971	1,020	4,602	183	10,160	17,973
Gatun ..	922	109	1,472	18	1,419	4,209
Gorgona ..	1,271	351	4,043	28	1,220	6,923
Las Cascadas.	357	201	837	54	460	1,909
La Boca.	624	196	983	28	166	2,007
Matachón	118	35	314	9	263	739
Paraiso	744	105	1,081	12	1,696	3,631
Pedro Miguel	1,806	456	781	11	1,404	4,458
San Pablo	41	8	102	2	94	357
Tabernilla	307	35	510	3	328	1,485
Total	19,139	4,706	29,287	605	37,180	90,928

I hereby certify that the above statement is correct.

TOM M. COCKE, *Collector of Revenues.*

ANCON, CANAL ZONE, July 1, 1907.

TABLE 12.—*Detailed statement of the number of registered pieces dispatched to foreign points by the Cristobal exchange office for period July 1, 1906, to June 30, 1907.*

Month	New York	Havana	Barbados	Trinidad	Colon	French "	Total
July ..	15	88	170		5		418
August ..	15	116	182		56		469
September ..	19	79	400	65	44		607
October ..	21	881	83	180	98		1,163
November ..	180	12	49	114	92		398
December ..	34	88	33	228	108	67	510
January ..	108	21	83	34	120	71	377
February ..	1	67	67	28	101	134	408
March ..	108	97	930	50	99	172	1,356
April ..	108	188	98	28	100	140	592
May ..	104	98	78	148	89	264	671
June ..	60	80	124	140	97	241	602
Total ..	511	1,011	8,188	2,476	1,039	1,100	40,927

I hereby certify that the above statement is correct.

TOM M. COCKE, *Collector of Revenues.*

ANCON, CANAL ZONE, July 1, 1907.

TABLE 13.—*Detailed statement of mail dispatches made from July 1, 1906, to June 30, 1907.*

Month.	New York.	Jamalca.	Barba- dos.	Trini- dad.	Port Limon.	New Or- leans.	French.	Total.
1906.								
July.....	11	2	3					16
August.....	8	2	2	4				16
September.....	8	3	2	2				15
October.....	8	3	2	2				15
November.....	10	4	4	2				20
December.....	9	6	4	3		2	1	25
1907.								
January.....	8	6	3	3		3	2	25
February.....	9	3	2	3		4	2	23
March.....	7	4	3	3	3	4	2	26
April.....	12	6	3	3	5	6	2	37
May.....	10	6	3	3	4	4	3	33
June.....	8	4	3	4	4	5	2	30
Total.....	108	49	34	32	16	28	14	281

I hereby certify that the above statement is correct.

TOM M. COOKE, *Director of Posts.*

ANCON, CANAL ZONE, July 1, 1907.

TABLE 14.—*Statement of money-order business during fiscal year ending June 30, 1907.*

Month.	Number of orders issued.	Amount of money orders issued.			Fees.
		On United States.	On Canal Zone.	Total.	
1906.					
July.....	2,754	\$94,127. 22	\$4,273. 83	\$98,401. 05	\$380. 26
August.....	4,774	121,248. 90	7,003. 26	128,252. 16	547. 46
September.....	4,455	111,908. 34	6,206. 62	118,114. 96	507. 36
October.....	5,840	140,705. 34	9,571. 78	150,277. 12	655. 41
November.....	5,883	141,573. 61	9,805. 98	151,379. 59	663. 32
December.....	6,785	163,084. 03	9,685. 00	172,769. 03	757. 52
1907.					
January.....	7,407	179,564. 62	21,486. 95	201,051. 57	863. 98
February.....	7,609	186,730. 18	32,580. 01	219,310. 19	920. 22
March.....	8,246	184,111. 25	37,747. 78	221,859. 03	955. 34
April.....	10,763	263,739. 51	59,383. 46	323,122. 97	1,340. 46
May.....	8,782	205,694. 94	47,317. 42	253,012. 36	1,066. 33
June.....	9,532	227,738. 71	53,676. 60	281,415. 31	1,174. 99
Total.....	82,830	2,020,226. 65	298,738. 69	2,318,965. 34	9,832. 65

Average amount of each money order, \$28 plus.
Correct.TOM M. COOKE, *Director of Posts.*

ANCON, CANAL ZONE, July 1, 1907.

TABLE 15.—*Sales of Panama postage stamps surcharged "Canal Zone" from July 1, 1906, to June 30, 1907.*

Month.	Value.	Month.	Value.
1906.		1907.	
July.....	\$3,412. 03	January.....	\$3,683. 58
August.....	2,985. 23	February.....	4,646. 87
September.....	3,725. 87	March.....	6,703. 45
October.....	3,401. 14	April.....	5,115. 70
November.....	4,941. 64	May.....	6,442. 54
December.....	4,928. 10	June.....	4,817. 64

Total value, \$54,803.79.

I hereby certify that the above statement is correct.

TOM M. COOKE, *Director of Posts.*

ANCON, CANAL ZONE, July 1, 1907.

TABLE 16.—Detailed statement of the collection of distillation tax from July 1, 1906, to June 30, 1907.

Month.	Number of licenses.	Amount.
1906.		
July.....	6	\$376.00
August.....	10	612.30
September.....	12	609.10
October.....	9	610.90
November.....	10	609.45
December.....	7	353.30
1907.		
January.....	6	195.75
February.....	7	340.25
March.....	6	219.30
April.....	5	250.50
May.....	8	472.00
June.....	10	309.30
Total.....	96	\$3,189.95

I hereby certify that the above statement is correct.

TOM M. COOKE, Collector of Revenues.

ANCON, CANAL ZONE, July 1 1907

TABLE 17.—Detailed statement of the collection of rent of lands and rent of buildings from July 1, 1906, to June 30, 1907.

Month.	Lands.	Buildings.	Total.
1906.			
July.....	\$465.20		\$465.20
August.....	985.53	\$22.80	1,008.33
September.....	401.55	24.00	425.55
October.....	977.72	19.75	997.47
November.....	574.00	1.75	575.75
December.....	285.31	37.50	322.81
1907.			
January.....	870.34	44.00	914.34
February.....	668.29	30.25	698.54
March.....	380.10	13.50	393.60
April.....	87.21	7.50	94.71
May.....	787.14	32.00	819.14
June.....	504.27		504.27
Total.....	7,741.43	232.85	7,974.28

I hereby certify that the above statement is correct.

TOM M. COOKE, Collector of Revenues.

ANCON, CANAL ZONE, July 1 1907

TABLE 18.—Detailed statement of the collection of miscellaneous collections from July 1, 1906, to June 30, 1907.

Month.	Miscellaneous collections.	Month.	Miscellaneous collections.
1906.			
July.....		July.....	\$722.10
August.....		August.....	825.66
September.....		September.....	1,124.80
October.....		October.....	1,352.30
November.....		November.....	1,654.61
December.....		December.....	1,314.44
1907.			
January.....		January.....	
February.....		February.....	
March.....		March.....	
April.....		April.....	
May.....		May.....	
June.....		June.....	

I hereby certify that the above statement is correct.

TOM M. COOKE, Collector of Revenues.

ANCON, CANAL ZONE, July 1 1907

TABLE 19.—*Division of customs.—Statement of vessels entering and clearing, and movement of passengers and cargo at the port of Cristobal, Canal Zone, during the fiscal year ending June 30, 1907.*

Nation.	Class.	Number entering.	Tonnage.	Number clearing.	Tonnage.
American.....	Steam.....	19	53,355	17	47,514
Do.....	Sail.....	9	2,974	9	2,974
British.....	Steam.....	31	55,682	33	59,823
Do.....	Sail.....	7	2,601	6	2,229
Norwegian.....	Steam.....	45	81,587	44	79,623
Danish.....	do.....	2	3,866	1	1,572
German.....	do.....	2	2,644	2	2,644
Swedish.....	do.....	1	438	1	438
Total.....		116	203,147	113	196,817

Services rendered seamen:	
Seamen discharged.....	8
Seamen shipped.....	50
Seamen deserted.....	7
Seamen deceased.....	0
Movement of passengers and cargo:	
Cargo arriving, transit.....	tons.. 17,894
Cargo arriving, local.....	do.... 258,910
Cargo departing, transit.....	do.... 16,062
Cargo departing, local.....	do.... 4,072
Passengers arriving.....	1,543
Passengers departing.....	1,285

I hereby certify that the above statement is correct.

TOM M. COOKE,

Collector of Revenues, *ex officio* Collector of Customs.

ANCON, July 1, 1907.

TABLE 20.—*Division of customs—Statement of vessels entering and clearing, and movement of passengers and cargo at the port of Ancon, Canal Zone, during the fiscal year ending June 30, 1907.*

Nation.	Class.	Number entering.	Tonnage.	Number clearing.	Tonnage.
American.....	Steam.....	60	119,532	61	122,071
British.....	do.....	64	75,602	63	74,986
Chilean.....	do.....	27	46,255	26	44,546
German.....	do.....	12	33,267	12	33,267
Total.....		163	274,656	162	274,870

Services rendered seamen:	
Seamen discharged.....	120
Seamen shipped.....	71
Seamen deserted.....	50
Seamen deceased.....	2
Movement of passengers and cargo:	
Cargo arriving, transit.....	tons.. 118,402
Cargo arriving, local.....	do.... 12,999
Cargo departing, transit.....	do.... 198,049
Cargo departing, local.....	do.... 212
Passengers arriving.....	5,912
Passengers departing.....	4,599

I certify that the above statement is correct.

TOM M. COOKE,

Collector of Revenues, *ex officio* Collector of Customs.

ANCON, CANAL ZONE, July 1, 1907.

APPENDIX 3. JUDICIARY DEPARTMENT.

TABLE 21. Statement of business transacted in court of the first judicial circuit of the Canal Zone, July 1, 1906, to June 30, 1907.

Month.	Cases filed.	Con- victed	Ac- quitted	Dis- missed.	Collections.	
					Fines.	Costs.
1906.						
July.....	2	2				
August.....	5	2	2	3	\$20 00	
September.....	2		4	3	30 00	\$17 30
October.....	12	5	1	7	20 00	20 25
November.....	15	7	2	6	122 00	7 85
December.....	7	3		1	100 00	9 25
1907						
January.....	11	6	1	5	20 00	7 60
February.....	9	3		4	20 00	3 30
March.....	9	5	1	2	37 00	14 20
April.....	6	4			24 00	7 30
May.....	10	2	2	1		
June.....	8	2	3	6		
Total..	90	44	21	38	679 00	87 06

Civil cases

Cases pending July 1, 1906.....	4
Cases filed.....	16
Cases settled.....	17
Cases pending June 30, 1907.....	3
Costs.....	\$61 40
Number of sessions of court.....	85

TABLE 22. Statement of business transacted in court of second judicial circuit of the Canal Zone, July 1, 1906, to June 30, 1907.

Month	Cases filed	Convicted	Acquitted	Dis- missed	Collections	
					Fines	Costs
1906.						
July.....		10	2	4	\$50 00	\$16 00
August.....	5		8	2	175 00	14 00
September.....	18	3		2	20 00	28 00
October.....	1	10	4	0		9 00
November.....			2	7	30 00	
December.....						
1907.						
January.....			1	1	10 00	2 45
February.....	5		1	0		
March.....		1				
April.....						
May.....					90 00	9 00
June.....					20 00	4 00
Total..		1	2	11	\$74 71	\$41 85

Civil cases

Cases pending July 1, 1906.....	18
Cases filed.....	45
Cases settled.....	47
Cases pending June 30, 1907.....	10
Costs.....	\$41 85
Number of sessions of court.....	71

TABLE 23.—Statement of business transacted in court of third judicial circuit of the Canal Zone, July 1, 1906, to June 30, 1907.

Month.	Cases filed.	Con- victed.	Ac- quitted.	Dis- missed.	Collections.	
					Fines.	Costs.
1906.						
July.....	6	5		1		
August.....	2		2			
September.....	2	3		1	\$25.00	\$6.70
October.....	4	1				
November.....	5	2	1	2	50.00	1.00
December.....	8	4			10.00	16.15
1907.						
January.....	4	5	2	2		
February.....	4	2	3			
March.....	3	1		1	5.00	2.80
April.....	9	2	1	3		
May.....	6	4	3	2	25.00	8.10
June.....	2	1	1			
Total.....	55	30	13	12	115.00	34.75

Civil cases:	
Cases pending July 1, 1906.....	8
Cases filed.....	25
Cases settled.....	23
Cases pending June 30, 1907.....	10
Costs.....	\$187.25
Number of sessions of court.....	112

TABLE 24.—Statement of business transacted in the supreme court of the Canal Zone, July 1, 1906, to June 30, 1907.

Total cases heard.....	15
Total cases decided.....	15
Total costs collected.....	\$61.55
Total sessions.....	17
Number of attorneys admitted.....	8

APPENDIX H.—CRIMINAL STATISTICS.

TABLE 25.—Statement of arrests made by the Canal Zone police department, July 1, 1906, to June 30, 1907, inclusive.

Charge.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	Total.
Abusive language.....		8		15		22		12	19	14	11	15	130
Accessory to petit larceny.....									1				1
Adultery.....	1					1	2				2		7
Affray.....													1
Aiding prisoner to escape.....					1								1
Attempt at arson.....												1	1
Arson.....					2								3
Assault.....	8	12	10	27	18	14	11	9	17	18	19	39	203
Accessory to murder.....								1					2
Assault and battery.....	6		4	8	14	14	11	4	10	12	21	13	128
Assaulting officer.....		2	6	1		1							10
Assault with deadly weapon.....	2		3	5		8	2	1	9	2	3	3	39
Assault with attempt to kill.....	1						1				1	3	6
Attempt to rape.....	1									1	1		3
Breaking jail.....			2										2
Burglary.....	1	7		10	1	6	4	3	7	1	2	6	49
Broaching cargo.....					1				1				3
Contempt of court.....	3	2		2		2	8	2	4	5	1		30
Creating nuisance.....	4												4
Crime against nature.....										1			1
Criminal neglect and manslaughter.....				1									1
Criminal carelessness.....			3										3
Cruelty to animals.....	5		3		5	3	2				1	1	21
Cruelty to children.....	1			1					2	1		1	6
Desertion of wife.....										2			2
Destroying Government property.....										9	1		10
Desertion from Marine Corps.....			6			1		1		1			9

TABLE 27.—Statement showing number of convicts in penitentiary during year ended June 30, 1907.

Convicts in confinement July 1, 1906.....	45	Number of convicts discharged, pardoned etc., during year ended June 30, 1907.....	48
Number of convicts beginning penitentiary sentences during the year ended June 30, 1907.....	85	Number of convicts in confinement June 30, 1907.....	82
	130		130

TABLE 28.—Statement of crimes committed by prisoners confined in the Canal Zone penitentiary, June 30, 1907.

Arson.....	2	Obstructing railroad track.....	1
Attempt to murder.....	3	Manslaughter.....	2
Burglary.....	18	Murder.....	1
Crime against nature.....	1	Rape.....	3
Embezzlement.....	1	Sodomy.....	1
Forgery.....	15	Rioting.....	3
Grand larceny.....	23		
Larceny.....	8	Total.....	82

TABLE 29.—Statement of occupation of prisoners confined in the Canal Zone penitentiary, June 30, 1907.

Blacksmith.....	1	Messenger.....	1
Brakeman.....	2	Molder.....	1
Carpenter.....	5	No occupation.....	2
Clerk.....	1	Oiler.....	1
Cook.....	1	Porter.....	1
Farmer.....	1	Sailor.....	5
Fireman.....	2	Switchman.....	1
Foreman.....	1	Vendor.....	1
Laborer.....	48	Watchman.....	1
Laundress.....	2		
Machinist.....	4	Total.....	82

TABLE 30.—Educational qualifications of prisoners confined in the Canal Zone penitentiary, June 30, 1907.

Able to read and write.....	52
Unable to read and write.....	30
Total.....	82

TABLE 31.—Statement showing nationality of prisoners confined in the Canal Zone penitentiary, June 30, 1907.

American.....	8	Jamaican.....	14
Antiguan.....	7	Nicaraguan.....	1
Barbadian.....	17	Panamanian.....	6
Chilean.....	4	Peruvian.....	4
Colombian.....	8	Porto Rican.....	1
Danish.....	1	Spanish.....	3
Ecuadorian.....	1	St. Lucian.....	1
East Indian.....	1		
German.....	1	Total.....	82
Italian.....	1		

TABLE 32.—Statement showing ages of Zone prisoners confined in the Canal Zone penitentiary, June 30, 1907.

Under 15 years.....	1
15 to 30 years.....	63
30 to 40 years.....	13
40 to 50 years.....	4
70 to 80 years.....	1
Total.....	82
Age of youngest prisoner.....	13
Age of oldest prisoner.....	77

APPENDIX 6.—FIRE DEPARTMENT.

TABLE 35.—Statement of fires in the Canal Zone and the amount of loss resulting, from October 1, 1906, to June 30, 1907.

Month.	Number of fires.	Total loss.	Govern- ment loss.
1906.			
October.....	0		
November.....	0		
December.....	4	\$110	\$110
1907.			
January.....	3	24	12
February.....	1	5	5
March ^a	5	110	110
April ^b	4	c 110,000	c 110,000
May.....	8	225	195
June.....	4	10	10

^a Fire in Panama, not included in above, resulted in loss of \$4,750 on building and contents.
^b Two fires in Colon, not included above, resulted in loss of \$10,000, none of which was Government property.
^c Fire on April 1 destroyed two-thirds of Mount Hope storehouse.

ANNEX 7 MUNICIPALITIES.

TABLE 1. *Statement of receipts and expenditures of the different municipalities of the Canal Zone from July 1, 1906, to April 14, 1907, inclusive.*

[All amounts in Panama silver.]

RECEIPTS.

Month.	Justice.	Real-estate tax.	Liquor licenses.	Slaughter tax.	Rentals.	Other taxes.	Over-payments.	Total receipts.
July	62,560.50	23,145.04	\$37,432.00	\$1,100.50	\$2,047.15	\$3,440.34	-	\$51,501.03
August	2,640.00	1,331.00	4,253.40	2,100.00	302.03	3,500.70	-	10,026.13
September	3,300.70	600.12	1,000.00	2,520.00	303.30	3,200.12	-	13,921.44
October	3,744.00	44.00	1,000.00	2,750.00	1,307.04	4,441.10	-	14,282.04
November	8,020.00	31.25	200.00	2,300.00	1,940.15	4,300.00	-	13,713.10
December	3,000.40	4.40	13,000.00	3,100.00	1,000.70	4,310.00	-	28,425.50
January	3,300.70	-	34,000.00	3,870.00	1,321.05	3,500.03	-	46,162.48
February	4,300.30	27.50	-	3,007.00	903.28	5,737.00	-	14,741.08
March	3,300.70	-	-	3,012.00	2,147.70	7,316.05	-	15,402.05
April 14	2,304.00	183.00	-	2,000.70	174.50	3,240.18	50.16	10,301.54
Total	23,501.10	3,372.51	48,715.40	27,330.20	13,802.00	33,102.62	.13	230,964.27

EXPENDITURES.

Month.	Government buildings.	Roads.	Public lights.	Schools.	Indigent.	Office furniture and supplies.	Justice.	Ferry boat.	Total expenditures.	Cash balance, end of month.
June	-	-	-	-	-	-	-	-	-	\$108,617.30
July	\$3,726.54	\$2,501.70	\$406.40	623.00	61.00	\$780.48	\$1,737.31	\$25.00	\$17,492.18	143,930.63
August	2,771.65	246.20	103.40	1,548.24	84.60	363.46	1,642.66	25.00	12,230.97	146,325.45
September	7,728.09	1,866.44	571.76	1,159.92	215.40	308.94	1,304.04	107.50	16,531.59	145,708.39
October	3,505.00	1,002.80	347.24	730.46	237.70	264.14	1,503.00	-	9,438.68	150,600.65
November	4,500.75	1,465.70	422.20	903.08	60.60	25.10	1,534.67	61.40	10,917.05	152,344.90
December	6,808.56	250.82	455.72	672.00	100.20	63.23	1,400.50	30.00	10,600.49	170,152.96

APPENDIX H.

REPORT OF THE CHIEF SANITARY OFFICER.

ANCON, CANAL ZONE, *August 23, 1907.*

SIR: During the fiscal year 1906-7 the health conditions of the Isthmus have been good. This can be best exemplified by calling your attention to a few statistics concerning our force.

During the preceding calendar year we averaged a force of 26,000 men; during the fiscal year, 32,000; the death rate for the two periods was, respectively, 41 per thousand and 39 per thousand, a marked improvement. I compare the calendar and fiscal years, as heretofore we have gotten together no report for the fiscal year.

The number of white employees, respectively, were 5,464 against 7,727, the annual death rates for these whites being 16.27 and 15.93, respectively, per thousand. Our negro employees averaged, respectively, 21,822 and 25,360, the death rate being 49.01 and 45.34. The total population of the Canal Zone, including Panama and Colon, averaged 66,011 and 87,215; the death rate 49.10 and 42.08.

These figures show a marked improvement in the death rate among all classes. The lowest difference existed among the whites. This was to have been expected, as the death rate among the whites was small during the previous year.

During the fiscal year great improvements have been made in housing and feeding the force. Men of the lower grade of laborers, the 20-cent men, are now required to take their meals at kitchens managed by the Commission; this gives them a wholesome and an abundant diet.

During the year the working ability of the force was kept at its maximum. We averaged only 29 per thousand absent from duty on account of sickness. This shows a very high state of efficiency as compared with any body of men of which I am able to get any record.

It is somewhat singular that the deaths from injury among employees should have increased from 47 to 104. This is a very large mortality from this cause. The total number of deaths among the employees from all causes during the fiscal year was 1,273, of which 104 were from accidents; i. e., considering the deaths among our employees, 1 out of every 12 was due to injury, which is very excessive.

A great many of them were due to railroad accidents from the fact that people use the track as a highway. This cause of accident could be done away with in great part if roads were built between the various villages along the line.

There were no cases of yellow fever at any point on the Isthmus during the year, the last case occurring in Colon in May, 1906.

You will notice that, as in all former years, the death rate of the negro employees is very much higher than that of whites, this year being as 3 to 1. It is apparent that the white man stands the conditions on the Isthmus just about three times as well as the negro; but the death rate among our negro employees is decreasing year by year, and I hope will eventually be the same as that of the whites.

Pneumonia, which for the past two years has been the greatest cause of death among our negro employees, is markedly decreasing. In July, 1906, the first month of the fiscal year, we had 86 deaths from pneumonia among our employees. The mortality from this disease has been steadily decreasing, until in June, 1907, the last month of the fiscal year, we had only 20 deaths.

The general work of the sanitary department has increased and expanded during the year as was made necessary by the general expansion of work on the canal. That the work of the department has been done efficiently is evidenced by the fact that though the area and population to be cared for have been greatly increased, still the general health conditions have steadily improved.

Very respectfully, yours,

W. C. GORGAS,
Chief Sanitary Officer.

CHAIRMAN ISTHMIAN CANAL COMMISSION,
Culebra, Canal Zone.

GENERAL STATISTICS.

Population, number of gold and silver employees separately and consolidated, deaths, and death rates, by months, for the fiscal year ending June 30, 1907.

JULY 1906.

	Popula- tion.	Deaths. ^a	Annual average per 1,000.
Employees of Canal Commission and Panama R. R. Co.:			
Gold.....	5,052	13	30.87
Silver.....	22,989	138	72.03
Total.....	28,041	151	64.71
Employees and civil population:			
Panama.....	26,199	111	50.84
Colon and Cristobal.....	13,578	88	77.77
Canal Zone.....	35,000	223	76.46
Total.....	74,777	422	67.76

AUGUST, 1906.

Employees of Canal Commission and Panama R. R. Co.:			
Gold.....	5,209	8	18.22
Silver.....	24,286	145	71.60
Total.....	29,555	153	62.12
Employees and civil population:			
Panama.....	26,400	122	55.45
Colon and Cristobal.....	14,078	70	60.00
Canal Zone.....	35,500	214	72.33
Total.....	75,978	406	64.12

^a Those credited to the Canal Zone include employees who died within the territorial limits of the Zone.

Population, number of gold and silver employees separately and consolidated, deaths, and death rates, by months, for the fiscal year ending June 30, 1907—Continued.

SEPTEMBER, 1906.

	Popula- tion.	Deaths. ^a	Annual average per 1,000.
Employees of Canal Commission and Panama R. R. Co.:			
Gold.....	5,003	7	15.00
Silver.....	22,661	128	57.81
Total.....	28,264	135	57.34
Employees and civil population:			
Panama.....	26,500	100	45.28
Colon and Cristobal.....	14,379	70	59.33
Canal Zone.....	36,079	180	60.00
Total.....	70,959	350	54.54

OCTOBER, 1906.

Employees of Canal Commission and Panama R. R. Co.:			
Gold.....	5,530	7	15.27
Silver.....	19,925	92	55.30
Total.....	25,445	99	46.68
Employees and civil population:			
Panama.....	26,700	98	44.04
Colon and Cristobal.....	14,710	76	62.04
Canal Zone.....	36,680	128	41.85
Total.....	78,090	302	40.40

NOVEMBER, 1906.

Employees of Canal Commission and Panama R. R. Co.			
Gold.....	5,640	5	10.64
Silver.....	20,232	61	30.18
Total.....	25,872	66	30.11
Employees and civil population:			
Panama.....	27,654	66	37.00
Colon and Cristobal.....	15,236	77	60.14
Canal Zone.....	37,991	78	21.64
Total.....	80,881	241	30.00

DECEMBER, 1906.

Employees of Canal Commission and Panama R. R. Co.			
White.....	8,199	8	11.10
Black.....	21,132	66	31.48
Total.....	29,331	74	30.27
Employees and civil population:			
Panama.....	28,563	106	44.51
Colon and Cristobal.....	15,737	48	30.60
Canal Zone.....	39,240	119	30.30
Total.....	83,540	273	30.21

^a Includes deaths of Canal Zone residents who died within the territorial limits of the Zone.

^b As the exact population was not given with respect to the gold rolls for month of December, but for the sake of uniformity of figures are considered as such, for this particular month, in the averages given.

Population, number of gold and silver employees separately and consolidated, deaths, and death rates, by months, for the fiscal year ending June 30, 1907—Continued.

JANUARY, 1907.

	Popula- tion.	Deaths. ^a	Annual average per 1,000.
Employees of Canal Commission and Panama R. R. Co.:			
White.....	8,303	9	13.01
Black.....	23,548	59	30.06
Total.....	31,851	68	25.62
Employees and civil population:			
Panama.....	30,489	105	41.33
Colon.....	13,596	53	46.78
Canal Zone.....	45,089	103	27.41

FEBRUARY, 1907.

Employees of Canal Commission and Panama R. R. Co.:			
White.....	8,504	10	14.11
Black.....	27,800	83	35.83
Total.....	36,304	93	30.74
Employees and civil population:			
Panama.....	31,063	82	31.68
Colon.....	13,852	51	44.18
Canal Zone.....	47,579	145	36.57

MARCH, 1907.

Employees of Canal Commission and Panama R. R. Co.:			
White.....	^b 9,173	12	15.69
Black.....	^b 27,214	110	48.50
Total.....	^b 36,387	122	40.23
Employees and civil population:			
Panama.....	31,569	62	23.56
Colon.....	14,078	38	32.39
Canal Zone.....	49,774	157	37.85

APRIL, 1907.

Employees of Canal Commission and Panama R. R. Co.:			
White.....	^b 10,170	9	10.61
Black.....	^b 27,995	114	48.86
Total.....	^b 38,165	123	38.67
Employees and civil population:			
Panama.....	31,983	81	30.39
Colon.....	14,263	53	44.50
Canal Zone.....	51,569	200	46.53

MAY, 1907.

Employees of Canal Commission and Panama R. R. Co.:			
White.....	^b 10,466	16	18.34
Black.....	^b 28,537	82	34.48
Total.....	^b 39,003	98	30.15
Employees and civil population:			
Panama.....	33,584	75	26.79
Colon.....	14,378	41	34.21
Canal Zone.....	51,988	147	33.93

^a Those credited to the Canal Zone include employees who died within the territorial limits of the Zone.

^b Compiled from pay rolls of the previous month.

Deaths by ages.

Under 1 year.....	429	From 60 to 70 years.....	117
From 1 to 4 years.....	117	From 70 to 80 years.....	51
From 4 to 10 years.....	54	From 80 to 90 years.....	20
From 10 to 20 years.....	272	From 90 to 100 years.....	5
From 20 to 30 years.....	1,041	Over 100 years.....	2
From 30 to 40 years.....	621	Ages unknown.....	209
From 40 to 50 years.....	463		
From 50 to 60 years.....	269	Total.....	3,670

Deaths of Isthmian Canal Commission and Panama Railroad employees, by nationality.

Antigua.....	33	Italy.....	8
Austria.....	1	Jamaica.....	265
Barbados.....	518	Martinique.....	92
Bolivia.....	1	Mexico.....	1
British Guiana.....	2	Montserrat.....	10
Canada.....	1	Nicaragua.....	2
Colombia.....	32	Panama.....	46
Costa Rica.....	1	Porto Rico.....	2
Cuba.....	2	San Salvador.....	1
Demerara.....	5	Scotland.....	1
Dominica.....	3	Spain.....	39
England.....	9	St. Kitts.....	8
France.....	15	St. Lucia.....	24
Fortune Islands.....	5	St. Thomas.....	4
Greece.....	8	St. Vincent.....	6
Germany.....	2	Trinidad.....	22
Grenada.....	17	Unknown.....	15
Guadeloupe.....	16	United States.....	41
Haiti.....	3	Venezuela.....	2
Holland.....	2	West Indies.....	6
India.....	1		
Ireland.....	1	Total.....	1,273

Causes of death of employees of Commission and Panama Railroad Company.

Abscess, hepatic.....	1	Ill-defined diseases.....	2
Accidental traumatism.....	104	Intestinal obstructions.....	4
Alcoholism, acute.....	3	Liver, abscess of.....	5
Anæmia.....	1	Liver, cirrhosis of.....	5
Ankylostomiasis.....	2	Lungs, congestion of.....	1
Apoplexy.....	2	Lungs, oedema of.....	1
Arthritis, chronic.....	2	Lungs, tuberculosis of.....	58
Beriberi.....	2	Meningitis.....	21
Biliary calculi.....	2	Meningitis, purulent.....	1
Broncho-pneumonia.....	13	Myocarditis.....	3
Bronchitis, acute.....	1	Nephritis, acute.....	36
Bright's disease.....	22	Oedema of the larynx.....	2
Burns.....	2	Paralysis.....	2
Cellulitis.....	1	Pericarditis.....	6
Diabetes.....	1	Peritonitis.....	16
Disease of nasal fossæ.....	1	Pleurisy.....	1
Drowning, accidental.....	2	Pneumonia.....	466
Drowning, suicidal.....	1	Pyæmia.....	5
Dysentery.....	56	Rheumatism.....	2
Dysentery, amœbic.....	2	Senile debility.....	2
Endocarditis.....	4	Septicæmia.....	27
Entero-colitis.....	3	Skull, fracture of.....	1
Epilepsy.....	1	Stomach, cancer of.....	1
Epithelioma of tongue.....	1	Stomach, carcinoma of.....	1
Fever, hæmoglobinuric.....	6	Suicide.....	1
Fever, malarial.....	205	Syncope.....	1
Fever, typhoid.....	95	Syphilis.....	1
Fractures.....	9	Tetanus.....	2
Gangrene.....	1	Thrombosis.....	1
Gonorrhea.....	1	Tuberculosis, pulmonary.....	6
Heart disease.....	16	Tuberculosis, millary.....	1
Heart, organic disease of.....	7	Uncinari.....	1
Hepatitis, acute.....	1	Lungs, gangrene of.....	3
Hemorrhage.....	3	Not stated.....	6
Hemorrhage, cerebral.....	2		
Empyema.....	5		
Hernia, strangulated.....	1	Total.....	1,273

List of deaths of white employees on the Isthmus, giving name, country, occupation, length of time on the Isthmus, age, and cause of death.

JULY, 1906.

Name	Country.	Occupation, etc	Time on Isthmus	Age.	Cause of death.
Dunn R. T.	United States	Engineer, Panama R. R.	(?)	(?)	Drowning.
Lawrence, Fred. . .	England	Machinist.	2 yrs . .	43	Lobar pneumonia.
Morgan, David A. . .	United States	Engineer department	(?)	43	Alcoholism and malarial fever.
Poinboeuf, C. A. . .	France	Engineering and construction.	8 mos.	41	Acute peritonitis.
Ramsey, J. P. . . .	Barbados	do . .	1 yr	24	Hæmoglobinuric fever.
Salerno, Gamelo. . . .	Italy	Sanitary department	6 mos.	31	Lobar pneumonia.
Small Henry.	Jamaica . .	(?)	(?)	37	Organic disease heart
Smith Elmer C. . . .	United States.	Assistant engineer	26 mos..	36	Malarial fever
Smith H. E.	do.	Panama R. R.	(?)	(?)	Drowning (Panama R. R. accident.

AUGUST, 1906.

Calender George. . .	France.	Engineer department	23 mos..	43	Pneumonia.
Frye Charles	United States.	Mining department	4 mos.	34	Burns.
Fontenot Edward. . .	Spain	Engineer department	6 mos.	38	Dysentery
Knaust Franz.	Germany.	Machinist	(?)	28	Burns
Nelson Gilbert H. . .	United States.	Panama R. R. (steam shovel).	(?)	32	Myocarditis chronic.
Retty, Alphonse	France.	Building construction	(?)	(?)	Cerebral hemorrhage.
Scott Robert F. . . .	United States.	General traction foreman	8 mos.	47	Railroad accident.
Sovarry Miguel. . . .	Spain.	Engineer department.	7 mos.	38	Dysentery.

SEPTEMBER, 1906.

Currie Eben	United States.	Engineer, Panama R. R.	27 days .	(?)	Railroad accident.
Edwards, J.	do	do	do	39	do
G. M.	do	Building construct	8 mos	3	Pneumonia.
M.	do	Truck driver	do	62	Railroad accident
Nice W.	do	Engineer, Panama R. R.	2 mos	do	do
Smith, E.	do	Engineer department	8 mos	33	Pneumonia
Walker George E. . . .	United States	Engineer, Panama R. R.	44 mos	49	Railroad accident

OCTOBER, 1906.

G.	do	Construction	6 mos	19	Pneumonia.
L.	do	do	do	do	do
L.	do	do	do	do	do
N.	do	do	do	do	do
O.	do	do	do	do	do
L.	do	do	do	do	do
V.	do	do	do	do	do
W.	do	do	do	do	do

NOVEMBER, 1906.

C.	do	do	do	do	do
M.	do	do	do	do	do
M.	do	do	do	do	do
L.	do	do	do	do	do

List of deaths of white employees on the Isthmus, giving name, country, occupation, length of time on the Isthmus, age, and cause of death—Continued.

DECEMBER, 1906.

Name.	Country.	Occupation, etc.	Time on Isthmus.	Age.	Cause of death.
Antonis, Antonio.....	Spain.....	Laborer.....	4 wks...	29	Pneumonia.
Boojer, Ollier.....	Austria.....	do.....	(?)	30	Typhoid fever.
Castillo, Benjamin.....	Panama.....	do.....	Native..	(?)	Meningitis.
Dodd, W. R.....	United States.	Engineer department.	29 mos..	38	Cardiac thrombosis.
Firth, Arthur.....	England.....	Mechanical depart- ment.	26 mos..	(?)	Fracture.
Giacimo, Fantoni.....	Italy.....	Laborer.....	1 mo....	24	Fracture of skull.
Savesta, Lozeno.....	do.....	do.....	15 days..	45	Malaria.
Weber, Leon.....	France.....	do.....	(?)	(?)	Fever.

JANUARY, 1907.

Casanoves, Antonio....	Spain.....	Laborer.....	(?)	25	Drowning.
Estaban, Monelic.....	do.....	do.....	2 mos...	26	Nephritis, chronic.
Fitch, Thomas.....	United States.	Panama R. R.....	18 mos..	35	Dysentery, amoebic.
Gonzales, Antonio.....	Spain.....	Engineering and con- struction.	8 mos...	24	Pneumonia.
Garcia, Leandro.....	do.....	Laborer.....	5 wks...	40	Do.
Marion, Dennis.....	United States.	Machinist.....	(?)	40	Intestinal obstruction.
Pruden, H. D.....	do.....	Electrician.....	3 wks...	29	Typhoid fever.
Ridley, Geo. V.....	do.....	Doctor.....	20 mos..	30	Pneumonia, lobar.
Wardell, Otis.....	do.....	Carpenter.....	3 mos...	24	Typhoid fever.

FEBRUARY, 1907.

Horne, W. R.....	United States.	Carpenter.....	9 mos...	29	Hæmoglobinuric fever.
Newman, Frank.....	do.....	do.....	6 mos...	41	Tuberculosis.

MARCH, 1907.

Feeney, Michael.....	United States.	Panama R. R.....	8 mos...	(?)	Accidental trauma- tism (P a n a m a R. R.).
Fountain, John H.....	do.....	Conductor.....	3 yrs....	29	Do.
James, Edward.....	do.....	Clerk.....	22 mos..	40	Septicæmia.
Kendal, Thomas.....	do.....	Engineer department.	4 yrs....	62	Malarial fever.

APRIL, 1907.

Ferandez, Jose.....	Spain.....	Laborer.....	3 mos...	21	Drowning.
Martinez, Amedel.....	Martinique...	Quinine dispenser....	12 mos..	26	Pneumonia.
Morena, Amorena.....	Spain.....	Laborer.....	2 mos...	22	Fever, typhoid.
Pon Yela, Juan.....	do.....	do.....	(?)	44	Accidental trauma- tism.
Powell, Horatio.....	England.....	Foreman.....	1 yr....	33	Dysentery.
Turner, Frank M.....	do.....	Engineer department.	15 mos..	50	Cirrhosis of liver.
King, S. I.....	United States.	Panama R. R.....	7 mos...	(?)	Septicæmia.
Murphy, Joseph.....	do.....	Machinist.....	1 yr....	37	Blackwater fever.
Rick, August J.....	do.....	Foreman.....	1 yr....	46	Septicæmia.
Little, Katherine L....	do.....	.....	8 mos...	13	Railroad accident (In- ternal hemorrhage).

MAY, 1907.

Apostal, Demetris.....	Greece.....	Laborer.....	(?)	33	Drowning.
Barzal, Leon.....	Spain.....	do.....	(?)	(?)	Powder blast.
Brava, Peitro.....	Italy.....	do.....	(?)	58	Drowning.
Delendos, Josef.....	Greece.....	do.....	(?)	23	Do.
Evanglius, Georgius....	do.....	do.....	15 days..	40	Pneumonia.
Fukla, Aristido.....	do.....	do.....	.....	27	Drowning.
Gill, Gregorie.....	Spain.....	do.....	4 mos...	32	Dynamite explosion.
Guelba, Angel M.....	Colombia.....	do.....	1 yr....	38	Meningitis.
Lithdukis, Costis.....	Greece.....	do.....	(?)	22	Drowning.
Pocernama, Abundo....	Spain.....	do.....	5 mos...	29	Accidental trauma- tism.
Sanchez, Manuel.....	Colombia.....	do.....	20 yrs...	20	Malaria.
William, Joseph.....	England.....	Cook.....	15 mos..	34	Fever, typhoid.

Causes of death—Continued

Classification.	Ancon Hos- pital.	Colon Hos- pital.	Line Hos- pital.	Panama.	Colon.	Zone.	Total.
I.—General diseases—Continued.							
Syphilis.....	1	2	1	1	..	1	6
Gonorrhea (5 years and over).....	1	..	..	..	..	..	1
Cancer and other malignant tumors of the buccal cavity.....	1	..	..	..	..	..	1
Cancer and other malignant tumors of stomach and liver.....	2	..	..	1	..	..	3
Cancer and other malignant tumors of peritoneum, intestines, and rectum.....	..	..	..	..	..	1	1
Cancer and other malignant tumors of female genital organs.....	..	2	..	..	1	..	3
Cancer and other malignant tumors of the breast.....	..	..	..	1	..	..	1
Cancer and other malignant tumors of other organs or of organs not specified.....	..	1	..	1	..	..	2
Other tumors (tumors of the female genital organs excepted).....	..	..	..	1	..	1	2
Acute articular rheumatism.....	..	..	..	2	..	2	4
Chronic rheumatism and gout.....	..	..	..	..	..	2	2
Diabetes.....	1	..	2	2	..	..	4
Anemia chlorosis.....	1	1	..	7	..	2	11
Other general diseases.....	2	..	..	2	..	..	4
Acute chronic rheumatism.....	..	..	1	..	1	4	6
Other chronic poisoning.....	..	2	..	2	..	1	5
II. — Diseases of the nervous system and the organs of special sense.							
Encephallitis.....	..	..	1	..	..	..	1
Simple meningitis.....	7	1	4	19	2	3	36
Epidemic cerebro-spinal meningitis.....	5	..	..	1	..	1	7
Pneumococcus meningitis.....	3	5	..	1	..	1	10
Congestion and hemorrhage of the brain.....	2	2	8	14	7	5	38
Softening of the brain.....	1	..	..	..	..	..	1
Paralysis without specified cause.....	..	..	..	1	..	1	2
General paralysis.....	3	..	..	1	..	1	5
Other forms of mental alienation.....	..	..	..	3	..	1	4
Epilepsy.....	..	..	..	..	2	1	3
Convulsions (nonpuerperal, 5 years and over).....	1	..	..	2	7	10	20
Convulsions (under 5 years).....	..	..	..	2	4	9	17
Tetanus.....	1	3	..	29	2	3	36
Other diseases of the nervous system.....	..	..	..	1	1	..	2
III Diseases of the circulatory system.							
Pericarditis.....	4	1	2	2	..	2	11
Pneumococcus pericarditis.....	..	1	..	..	..	..	1
Acute endocarditis.....	..	1	1	7	..	2	11
Septic endocarditis.....	1	1	..	..	..	..	2
Organic diseases of the heart.....	7	10	8	17	13	22	77
Angina pectoris.....	..	..	..	3	..	1	4
Aneurism.....	1	1	5	5	..	1	13
Embolism and thrombosis.....	..	1	..	..	..	..	1
Elephantiasis.....	..	1	..	..	..	..	1
Hemorrhages.....	2	..	..	4	4	5	15
Other diseases of the circulatory system.....	..	2	..	7	2	..	11
IV. Diseases of the respiratory system.							
Diseases of the nasal fossae.....	1	..	..	..	..	..	1
Diseases of the larynx.....	..	1	..	2	..	2	5
Acute bronchitis.....	..	..	1	18	5	1	25
Chronic bronchitis.....	3	..	..	6	..	..	9
Broncho-pneumonia.....	20	4	5	14	5	..	48
Pneumonia.....	213	86	130	129	64	46	668
Pleurisy.....	3	..	1	3	1	..	8
Congestion and apoplexy of the lungs.....	1	..	1	6	..	..	10
Gangrene of the lungs.....	..	2	1	..	1	..	4
Pulmonary emphysema.....	..	..	1	..	1	..	2
Other diseases of the respiratory system (phthisis excepted).....	1	..	..	9	..	..	10
V. Diseases of the digestive system							
Diseases of the mouth and its adnexa.....	..	..	1	..	..	1	2
Diseases of the pharynx.....	..	..	..	1	..	..	1
Other diseases of the stomach (cancer excepted).....	..	1	..	1	..	..	2
Diarrhea and enteritis (under 2 years).....	3	4	..	27	15	16	65
Chronic diarrhea and enteritis (under 2 years).....	..	..	1	10	0	5	22
Diarrhea and enteritis (2 years and over).....	2	..	..	30	1	7	40
Intestinal parasites.....	1	..	..	6	..	..	7
Uncinariasis.....	..	1	..	..	..	..	1

Causes of death--Continued

Classification.	Ancon Hos- pital.	Colon Hos- pital.	Liter Hos- pital.	Parana- ma.	Colon.	Zona.	Total.
V.—Diseases of the digestive system—Continued.							
Hernia and intestinal obstructions:	5		1	7	1	4	18
Other diseases of the intestines:	1			12	1	2	16
Cirrhosis of the liver		2	5	6	2	5	20
Biliary calculi			1	2		1	4
Other diseases of the liver.	7	2	3	8	4	5	29
Diseases of the spleen		1					1
Simple peritonitis	8	2	3	7	5	4	29
Other diseases of the digestive system (cancer and tuber- culosis excepted)		1		14		1	16
Appendicitis and abscess of the iliac fossa				3			3
VI.—Diseases of the genito-urinary system and its adnexa.							
Acute nephritis	7	8	4	16	2	8	45
Bright's disease	27	21	20	50	7	12	137
Other diseases of the kidneys and their adnexa.	1	1		3	1		6
Diseases of the bladder				1			1
Diseases of the urethra, urinary abscess, etc.	3					1	4
Cysts and other tumors of the ovary				1			1
Other diseases of the female genital organs				1			1
VII.—The puerperal state.							
Accidents of pregnancy	1			1		3	5
Puerperal hemorrhage				1			1
Other accidents of labor.	1			3		4	8
Puerperal septicemia		3		1	1	3	8
Puerperal albuminuria and convulsions				2	1	3	6
Other puerperal accidents—sudden death						1	1
VIII.—Diseases of the skin and cellular tissue.							
Gangrene		1	2			1	4
Acute abscess phlegmon	1			1	1		3
Other diseases of the skin and cellular tissue	1			2			3
IX.—Diseases of the organs of generation							
Neuritis							
Atrophy							
Angioma	1		1				2
Other diseases of the organs of generation				1			1
X.—Metastases							
Congestive metastases—stroke excepted	2	9	3	8	19	24	55
XI.—Other							
Scalds		1		9	3	16	29
XII.—Fractures							
Fracture of the humerus				1			1
Fracture of the radius and ulna				1			1
Fracture of the tibia and fibula		1				1	2
Fracture of the femur					1		1
Other fractures	3	4	4	2	1	4	18
Other diseases of the bones	2		10	9	8	72	101
Dislocations				6			6
Amputations					12	28	40
Other diseases of the joints				1	1		2
Other diseases of the muscles				3			3
Other diseases of the ligaments	1			6	1	2	10
XIII.—Burns							
Burns				7	1	10	18
Cancers		4	10	3	2	40	59
Scalds		41	44	106	56	148	395

Monthly report of hospitals for the year ending June 30, 1907.

JULY, 1906.

Hospitals.	Patients in hospital first of month.			Admitted during month.			Died during month.			Discharged during month.			Patients in hospital end of month.			
	Canal em- ploy- ees.	Rail- road em- ploy- ees.	Non- em- ploy- ees.	Canal em- ploy- ees.	Rail- road em- ploy- ees.	Non- em- ploy- ees.	Total.	Canal em- ploy- ees.	Rail- road em- ploy- ees.	Non- em- ploy- ees.	Total.	Canal em- ploy- ees.	Rail- road em- ploy- ees.	Non- em- ploy- ees.	Total.	
Ancon	330	43	63	1,405	69	112	1,586	72	2	11	85	1,340	80	50	51	404
Colon	173	50	57	854	183	235	1,272	24	4	18	46	738	183	46	108	419
Miraflores.	79	20	107	242	11	28	281	10	..	10	20	228	20	5	94	182
Gorgona..	27	1	..	140	13	4	157	3	..	2	5	140	12	2	1	77
Culebra	48	3	..	307	2	7	316	21	..	1	22	271	3	2	1	66
Empire	13	..	..	301	7	7	309	0	..	1	10	291	..	..	..	14
Bas Obispo	..	..	..	99	4	1	104	3	..	..	3	80	3	1	..	17
Tabernailla	..	..	..	381	32	9	422	17	..	..	17	309	27	5	3	63
Total.....	670	117	227	3,729	314	403	4,446	159	6	43	208	3,307	334	91	258	1,102

AUGUST, 1906.

	323	30	31	404	1,170	71	120	1,361	55	3	11	69	1,081	45	76	1,203	357	52	84	463
Ancon.....	245	40	108	419	897	188	168	1,273	18	5	19	42	918	181	206	1,304	236	48	72	346
Miraflores.....	63	3	94	182	230	4	26	266	12	..	8	20	219	2	14	234	88	7	99	194
Gorgona.....	24	2	1	27	157	29	2	168	5	..	1	6	146	31	1	180	26	..	1	20
Culebra.....	63	2	1	66	342	4	2	348	23	..	..	23	328	6	2	336	54	..	1	55
Empire.....	14	..	..	14	335	..	2	337	4	..	..	4	331	..	2	333	14	..	..	14
Bas Obispo.....	16	1	..	17	114	10	2	126	0	..	..	9	101	11	1	113	20	..	1	21
Taberna.....	36	5	3	63	426	59	..	485	10	2	..	12	415	57	3	475	56	5	..	61
Taboga.....	48	5	2	55	106	14	16	196	..	..	..	..	180	18	17	224	25	1	1	27
Total.....	891	96	260	1,247	3,843	379	358	4,580	136	10	39	185	3,730	362	320	4,402	868	113	259	1,240

11. year ending June 30, 1907—Continued.

1 MAR, 1908

	Died during month.			Discharged during month.			Patients in hospital end of month					
	Canal em- ploy- ees.	Rail- road em- ploy- ees.	Non- em- ploy- ees.	Total.	Canal em- ploy- ees.	Rail- road em- ploy- ees.	Non- em- ploy- ees.	Total.	Canal em- ploy- ees.	Rail- road em- ploy- ees.	Non- em- ploy- ees.	Total.
1	882	42	3	88	758	70	92	920	305	61	71	397
2	883	25	5	40	898	132	140	939	231	56	63	350
3	133	12	8	20	170	16	13	199	60	12	90	168
4	140	5	1	6	139		4	143	20			20
5	241	17	2	19	239		4	243	34			34
6	253	8		3	265		6	271	12			12
7	157	4		4	159	1	4	164	16	3	1	20
8	265	2		2	245	53		298	21	5		26
9	142				123	2	22	147	27	3	2	32
10	165	5		5	135	2	2	139	21			21
11	344	115	8	157	2,490	277	267	2,743	708	140	233	1,081

10 APR, 1908.

12	1,028	31	4	44	804	93	84	881	369	64	57	400
13	845	25	5	50	859	128	90	856	201	34	54	289
14	68	4	1	16	49	7	22	76	24	8	106	140
15	139	1	1	2	139		3	142	14			15
16	140	0		9	182		1	182	82			32
17	60	3		3	71			72	4			4
18	63	2		2	81	6	3	90	11			11
19	141	4		4	106	44	8	150	6	8		13
20	113	4		4	110	2		120	10			10
21	87	3	1	4	72	1		73	10			10
22	164				127	6	24	150	23	1	8	37
23	2,921	60	10	136	2,370	290	244	2,603	613	115	233	961

NOVEMBER, 1906.

Ancon.....	269	64	67	400	694	56	80	620	24	1	4	29	633	62	76	771	206	57	67	420
Colon.....	201	34	34	286	587	128	112	827	23	4	21	48	610	116	71	797	155	42	74	271
Culebra.....	32			33	120			120	1			1	119			119	32			32
Miraflores.....	24	8	106	140	24	2	30	66	1		9	30	29	3	16	50	18	7	111	126
Gorgona.....	14			15	120			62	1		2	3	60		1	70	4			4
Bas Obispo.....	11			11	55	3		58	2			2	56	3		59	8			8
Las Cascadas.....	10			10	59	1		60	1			1	61	1		62	7			7
Empire.....	4			4	63	2		65	2			2	61	2		83	4			4
Paraiso.....	10			10	68			68	2			2	68			88	8			8
Tabernailla.....	5	8		13	68	11		79	1				72	19		91				
Taboga.....	33	1	3	37	89	3	22	115					89	3	21	113	33	1	5	39
Total.....	613	115	233	961	1,897	206	247	2,350	58	5	36	90	1,987	206	187	2,283	565	107	257	929

DECEMBER, 1906.

Ancon.....	296	57	67	420	1,004	92	69	1,165	40	3	8	51	965	65	77	1,127	225	61	51	467
Colon.....	155	42	74	271	514	141	101	1,756	7	2	14	23	499	141	90	1,739	163	40	62	265
Culebra.....	29			29	167			167	8			8	169			159	29			29
Miraflores.....	18	7	111	135	14	1	16	31	3		8	11	10		21	31	19	8	98	125
Bas Obispo.....	8			8	61	3		64	4			4	56	3		58	9			9
Empire.....	4			4	108			113	1			1	106			108	7		1	8
Paraiso.....	8			8	69			69	1			1	70			70	6			6
Las Cascadas.....	7			7	86	2	3	91					84	2	2	88	8		1	10
Gorgona.....	4			4	87			89	2		1	3	82		2	84	6			6
Taboga.....	34		5	39	125		19	144					131		17	149	28		7	25
Total.....	563	106	257	926	2,236	242	211	2,699	66	5	31	102	2,161	234	216	2,613	571	109	220	900

REPORT ISTHMIAN CANAL COMMISSION.

th ending June 30, 1907 Continued.

JANUARY, 1907.

Admitted.	Died.		Discharged.		Patients remaining at end of month	
	Employees	Non-employees	Employees	Non-employees	Employees.	Non-employees
Total.	Total.	Total.	Employees	Non-employees.	Total.	Total.
1,363	67	31	1,201	34	1,285	454
774	21	33	676	52	767	249
100	7	14	164	12	154	28
83	4	5	73	12	35	112
74	2	2	62	3	64	13
136	1	1	68	1	69	11
143	2	2	45	2	47	9
72	.....	2	67	1	67	7
145	.....	2	100	30	110	23
183	.....	..	141	30	177	40
3,109	64	57	2,543	220	2,763	969
262		33			717	252

FEBRUARY, 1907.

84	1,076	36	5	41	587	57	944	409	47	456
53	600	23	14	37	155	92	635	308	59	367
5	170	6		6	19	14	131	35	1	26
58	46	6	7	15	19	14	33	10	117	123
2	90	1		1	68	1	60	20	....	70
2	93	1		1	80	2	62	12	..	81
....	118			..	64	2	61	7	..	11
1	124	1		1	126	2	129	16	..	108
....	49	1		1	46	2	66	8	..	53
45	196	....		....	126	44	170	31	5	165
219	2,041	76	26	101	2,144	303	2,349	702	229	931

Total

MARCH, 1907.

Ancon.....	409	47	456	992	82	1,074	38	6	44	1,002	69	1,071	290	51	341
Colon.....	208	59	267	596	89	685	42	16	58	549	74	623	199	58	257
Culebra.....	35	1	36	151	1	152	8		8	135	2	137	42		42
Miraflores.....	16	117	133	18	23	41	5	5	10	15	13	28	14	122	136
Las Cascadas.....	15		15	88	4	92	2		2	85	3	88	5		5
Bas Obispo.....	20		20	82		82	1		1	78		78	6		6
Paraiso.....	8		8	93		93	1		1	92		92	6		6
Gorgona.....	13		13	82	2	84	3		3	74	1	75	9		9
Empire.....	7		7	85		85	1		1	34		34	6		6
Taboga Sanitarium.....	31	5	36	147	42	189				146	35	181	32	12	44
Total.....	762	229	991	2,334	243	2,577	101	27	128	2,210	197	2,407	609	243	852

APRIL, 1907.

Ancon.....	290	51	341	880	83	963	61	9	70	675	68	743	372	56	428
Colon.....	199	58	257	430	92	522	32	20	52	415	70	485	174	57	231
Culebra.....	42		42	118	1	119	7		7	127		127	24	1	25
Miraflores.....	10	40	50	6	10	16		5	5	13	6	19	2	30	41
Gorgona.....	9		9	63	1	64	1	1	2	49		49	6		6
Paraiso.....	6		6	62		62	4		4	52		52	8		8
Las Cascadas.....	5		5	53	3	56				40	1	41	4	1	5
Bas Obispo.....	6		6	44		44				30		30	2		2
Empire.....	6		6	43		43	1		1	20		20	3		3
Taboga Sanitarium.....	30	7	37	149	33	182				151	32	183	28	8	36
Total.....	603	156	759	1,948	223	2,071	106	35	141	1,572	177	1,749	623	162	785

MAY 1907.

Ancon.....	372	56	428	886	81	967	41	5	46	752	73	825	449	59	508
Colon.....	174	57	231	309	99	408	19	13	32	307	70	377	151	72	223
Culebra.....	24	1	25	95		95	8	1	9	73		73	34		34
Gorgona.....	6		6	33		33				19		19	6		6
Las Cascadas.....	4	1	5	61	1	62	2		2	46	2	48	7		7
Miraflores.....	8	117	125	9	12	21	1	5	6	9	8	17	7	116	123
Paraiso.....	8		8	63		63				57		57	7		7
Bas Obispo.....	2		2	35		35	1		1	18		18	6		6
Empire.....	3		3	33		33	2		2	15		15	5		5
Taboga Sanitarium.....	28	8	36	113	22	135				118	27	145	23	3	26
Total.....	629	240	869	1,647	215	1,852	74	24	98	1,414	180	1,594	695	250	945

Monthly report of hospitals for the year ending June 30, 1907 Continued.

	Total number of employees remaining in hospitals	Total number of employees constantly sick in hospitals during month	Average number sick daily in hospitals, per thousand	Total number of employees constantly sick in sick camp during month	Average number sick daily in sick camps, per thousand	Total number of employees constantly sick in hospitals and sick camps during the month	Total average number sick daily in hospitals and sick camps per thousand
1906.							
July	935	888.53	31.68	219.41	7.82	1,107.93	39.50
August	976	995.74	33.72	264.83	8.95	1,260.57	42.67
September	848	821.88	29.09	243.10	8.65	1,064.98	37.74
October	728	719.30	28.20	138.35	5.42	857.65	33.62
November	672	688.88	26.63	110.59	4.27	799.47	30.89
December	680	706.52	26.13	130.15	4.44	836.67	30.57
1907.							
January	717	744.12	23.36	106.55	3.35	850.67	26.71
February	762	741.11	30.41	156.77	4.32	897.88	24.73
March	609	706.02	19.40	130.05	3.57	836.07	22.97
April	623	728.33	19.08	94.39	2.44	822.72	21.52
May	695	656.79	16.84	84.11	2.15	740.81	18.99
June	848	757.23	19.09	108.23	2.72	865.46	21.82
Total	9 083	9,214.35	293.62	1,786.53	58.10	11,000.78	351.73
Average, per month, for the year	757	767.86	24.46	148.87	4.84	916.73	29.31

*Summary of the work of the sanitary department in the city of Panama for the fiscal year 1906-7.***Street cleaning and garbage collection:**

Daily average number of men at work during the year	51
Daily average number of cars used during the year	18
Total number loads of sweepings	10,921
Total number loads of garbage	25,743
Total number of miscellaneous loads carted	15
Times street-sweeping machines used	90

Street sprinkling

Times street sprinklers used	745
Number of gallons sprinkled on streets	2,736,509

Inspection of yards

Houses inspected and found in good condition	1,274
Houses inspected and found in bad condition	598
Houses with water connections	1,456
Houses without water connections	605
Houses with sewer connections	1,418
Houses without sewer connections	619
Water-closets in good condition	1,348
Water-closets in bad condition	481
Yards with drainage good	1,189
Yards with drainage bad	352
Traps in yards connected with sewer	1,489
Traps in yards not connected with sewer	252
Tanks on premises	18
Wells on premises	79
Persons notified as to insanitary condition of their yards	1,706
Persons notified to connect with water and sewers	62
Persons warned for having mosquito larvæ	1,116
Persons fined by local authorities	79
Places where mosquito larvæ were found	1,470

House cleaning and whitewashing (for first three months):

Daily average number of men at work	20
Total number of rooms cleaned	872
Total number of rooms whitened	1,597
Total number of walls whitened	809
Total number of yards cleaned	32
Total number of carts of rubbish removed	12

Anopheles brigade:

Number of linear feet of ditches cleaned.....	383,719
Number of linear feet of ditches dug.....	13,393
Number of square feet of weeds and grass cut.....	1,423,580
Number of cisterns filled.....	1
Number of wells filled.....	381
Number of cubic yards of earth used.....	10,056
Number of drains oiled.....	27
Number of trenches oiled.....	67
Number of yards oiled.....	109
Number of wells oiled.....	6
Number of linear feet of cement laid.....	2,240
Mosquito oil used in oiling wells, pools, etc. (barrels).....	462
Number of cesspools filled.....	28
Number of days carts worked.....	282
Daily average number of carts at work.....	7
Districts oiled: Cocoa Grove, Boulevard Ancon, Avenida Central, Avenida A, Avenida B, Avenida Norte, Avenida Sur, Plaza Nacional, Palaza Arango, Panama Railroad yards, Guachapali, Murnon, Galelema, Trinchera, Pueblo Nueva, San Miguel, Granillo, and Boulevard de la Boca.	

Free distribution of water

Number of water carts in use (daily).....	9
Water distributed during the year at points in town where hydrants are not readily accessible..... gallons.....	3,615,840

Stegomyia brigade.

Number of times houses were inspected.....	45,502
Houses closed so they could not be inspected.....	2,291
Houses where larvae were found.....	2,665
Tanks reported in good condition.....	335
Tanks reported in bad condition.....	1,614
Wells reported in good condition.....	1,661
Wells reported in bad condition.....	1,383
Cisterns reported in good condition.....	49
Cisterns reported in bad condition.....	59
Barrels reported in good condition.....	518
Barrels reported in bad condition.....	3,580
Persons reported as in unsanitary condition of yard.....	1,222
Persons reported as having unsanitary yards.....	44
Persons reported as having mosquito larvae.....	59

Disinfection brigade.

Number of houses disinfected.....	239
Number of streets disinfected.....	323
Number of boats, stores, etc., and disinfected.....	1,563
Number of persons disinfected.....	5,965,839

Malaria brigade.

P.....	pounds.....	1,611
S.....	do.....	15,120
A.....	gallons.....	617
P.....	.....	59
M.....	.....feet.....	7,070
I.....	barrels.....	29
C.....	pounds.....	1
I.....	do.....	8
A.....	packages.....	2
A.....	do.....	2
I.....	gallons.....	7
C.....	pounds.....	7
N.....	do.....	7
I.....	.....	9
N.....	.....	3
N.....	.....	28
C.....	gallons.....	898
I.....	feet.....	100

Sick inspection:

Number of hotels inspected (daily).....	28
Number of persons reported ill.....	358

New buildings:

Plans of houses to be constructed, submitted to health officer and approved.....	201
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Summary of the work of the sanitary department for the fiscal year 1906-7 in the cities of Colon and Cristobal (including Mount Hope, Gatun, and Brazos Camp).

Sanitation, Cristobal:

Number of cans of garbage removed.....	105, 818
Number of loads of yard garbage carted.....	5, 846
Number of blocks of street cleaned.....	4, 215, 903
Miscellaneous loads carted.....	373
Number of cans of night soil removed.....	128, 231
Number of night-soil cans installed.....	141
Number of loads to and from storehouse.....	67

Stegomyia mosquito brigade, Cristobal:

Square yards of vegetation removed.....	131, 485
Water receptacles overturned.....	4, 939
Water receptacles destroyed.....	35
Water receptacles collected.....	70, 656
Barrels spigoted.....	125
Barrels covered.....	253
Barrels oiled.....	559
Square yards of lagoon oiled.....	29, 954
Crab holes oiled.....	30, 566
Crabs killed.....	10, 571
Pools oiled.....	17, 745
Barrels destroyed.....	242
Tanks oiled.....	1, 603
Number of feet of concrete drain cleaned.....	264, 305
Total number of breeding places eradicated.....	1, 104

Sanitation, Colon:

Number of cans of garbage removed.....	308, 328
Loads of yard garbage carted.....	2, 662
Number of cans of night soil removed.....	523, 947
Miscellaneous loads carted.....	741
Number of nuisances reported.....	565
Number of nuisances abated.....	221
Number of yards inspected.....	583
Square yards of street watered.....	6, 664, 630
Cars of dirt unloaded.....	2, 427
Square yards of street cleaned.....	910, 439
Number of night-soil cans installed.....	1, 396
Loads to and from storehouse.....	554
Number of new water-closets built.....	223

Stegomyia brigade, Colon:

Square yards of vegetation removed.....	2, 146, 559
Water receptacles overturned.....	48, 185
Water receptacles collected.....	551, 866
Water-closets oiled.....	5, 628
Barrels spigoted.....	1, 367
Barrels covered.....	8, 605
Barrels destroyed.....	9, 661
Barrels elevated.....	11
Barrels oiled.....	3, 802
Wells oiled.....	353
Tanks oiled.....	574
Pools oiled.....	59, 955
Crab holes oiled.....	6, 613
Square yards of lagoon oiled.....	844, 290
Number of linear feet of drainage made.....	2, 640
Number of feet of drain oiled and cleaned.....	963, 654
Breeding places eradicated.....	9, 688

Sanitation, Mount Hope:

Number of cans of garbage carted.....	22,072
Number of cans of night soil removed.....	21,358
Square yards of vegetation removed.....	339,977
Square yards of brush burned.....	863,141
Linear feet of drain cleaned.....	568
Number of nuisances reported.....	347
Number of nuisances abated.....	343

Stegomyia mosquito brigade, Mount Hope:

Linear feet of drain cleaned.....	1,870
Barrels sprayed.....	861
Barrels oiled.....	2,960
Barrels covered.....	1,768
Tanks oiled.....	17,705
Total number of breeding places eradicated.....	1,634
Linear feet of drain made.....	1,908
Water receptacles overturned.....	64,902
Water receptacles collected.....	41,961
Pool oiled.....	78,157
Square yards of lagoon oiled.....	49,259

Mount Hope Cemetery:

Square yards of vegetation removed.....	256,607
Square yards of underbrush removed.....	126,006
Linear feet of drain made.....	1,762
Number of interments.....	811
Number of graves lined and graded.....	1,397
Number of graves dug.....	327
Number of disinterments.....	65
Stumps removed.....	290

Sanitation, Gatun, for first ten months:

Square yards of vegetation removed.....	524,689
Number of cans of garbage removed.....	22,326
Number of cans of night soil removed.....	11,321
Number of night soil cans installed.....	66
Number of new water-closets built.....	35
Number of nuisances reported.....	3
Number of nuisances abated.....	7
Number of breeding places removed.....	168

Sanitation, Gatun, for first six months:

Square yards of vegetation removed.....	524,689
Number of cans of garbage removed.....	2,943
Number of cans of night soil removed.....	146
Number of night soil cans installed.....	458
Number of new water-closets built.....	20,427
Number of nuisances reported.....	106,181
Number of nuisances abated.....	208,200
Number of breeding places removed.....	3,578
Number of graves lined and graded.....	8,977
Number of graves dug.....	104

Sanitation, Gatun, for last six months:

Number of nuisances reported.....	1,000
Number of nuisances abated.....	1,820

1	60,000
---	--------

1	14,000
---	--------

1	21,800
---	--------

1	1,000
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Quarantine transactions at the ports of Ancon and Panama and Colon and Cristobal for the fiscal year 1906-7

Number of vessels inspected and passed	830
Number of vessels detained in quarantine	9
Number of vessels fumigated on arrival	17
Number of vessels fumigated prior to sailing	86
Total number of crew inspected	55,789
Total number of passengers inspected	57,815
Total number of persons inspected	113,604
Total number of persons vaccinated at ports of arrival on account of compulsory vaccination law	19,224
Total number of persons vaccinated at ports of departure on account of compulsory vaccination law	15,365
Total number of persons vaccinated on account of the compulsory vaccination law	34,589
Total number of passengers held in quarantine at the detention stations to complete period of incubation of yellow fever, smallpox, and plague	2,609
Total number of persons held under observation on board to complete period of incubation of yellow fever, smallpox, and plague	294
Total number of crew held under observation on board to complete period of incubation of yellow fever, smallpox, and plague	64
Total number of persons held under observation in quarantine and on board to complete period of incubation of yellow fever, smallpox and plague	2,967
Total number of passengers landed from foreign ports (cabin, 16,505, steerage, 31,179)	47,684
Total number of passengers embarked for foreign ports (cabin, 12,014, steerage 15,562)	27,576
Total number of persons arriving from coast towns on launches and small sailing craft	15,215
Total number of persons leaving for coast towns on launches and small sailing craft	11,969
Total immigration for the year from foreign ports (cabin, 6,346, steerage, 20,902)	27,248
Total immigration for the year from coast towns (approximate)	3,297
Total increase for the year	30,545
Total number of pieces of baggage disinfected	747
Total number of immigrants recommended for rejection	44
Total number of certificates issued to outgoing passengers	659
Total number of persons refused certificates because of immigration regulations	46
Total number of bills of health issued	5
Total number of bills of health viséed	228
Total number of circulars relative to malarial fever distributed	34,065

Quarantine transactions at the port of Bocas del Toro for the fiscal year 1906-7

Number of vessels inspected and passed	336
Number of crew inspected	6,118
Number of persons held to complete period of incubation of yellow fever	153
Total number of vessels sailing during the month	332
Total number of vessels entering during the month	347
Number of vessels fumigated on arrival	86
Number of vessels fumigated prior to departure	70
Number of persons vaccinated	274
Total number of passengers inspected	2,494

Sanitation of the Canal Zone, by months, for the fiscal year 1907.

	Brush cut and burned or re- moved	Swamps drained and filled.	Grass cut and burned.	New ditches dug.	Tile drain laid	New ditches stoned and ce- mented and v- shaped	Old ditches stoned and ce- mented	Old ditches cleaned and graded.
	Square yards	Square yards.	Square yards	Linear feet	Linear feet.	Linear feet	Linear feet.	Linear feet
1906.								
July.....	1,214,143	500,150	1,260,805	7,276	..	1,300	125	140,206
August.....	1,318,006	157,316	1,142,750	13,979	.....	1,233	61	245,054
September.....	2,104,366	15,303	1,140,501	23,964	.....	1,364	710	186,610
October.....	519,262	12,192	2,263,503	10,441	422	2,345	160	167,219
November.....	646,700	7,719	4,056,472	13,184	863	3,464	2,505	152,622
December.....	2,521,932	26,839	5,340,135	13,007	487	5,130	441	146,152
1907.								
January.....	2,030,920	57,270	6,516,573	22,769	6,694	2,465	1,600	182,217
February.....	2,145,663	51,788	3,109,352	22,379	7,972	2,444	734	182,055
March.....	1,750,413	60,972	1,350,127	18,351	16,048	2,843	1,598	139,219
April.....	643,001	2,936	432,146	28,058	8,372	5,331	2,116	129,911
May.....	716,068	15,742	1,140,843	10,364	2,513	2,926	244	197,596
June.....	339,263	87,698	2,581,224	22,545	6,510	5,846	799	164,081
Total.....	15,937,065	1,003,931	30,362,489	217,307	49,691	36,756	11,574	2,057,012

	Closet pits dug.	Closet pits filled in.	Closets erected.	Closets eared for	Garbage cans emptied.	Night- soil cans emptied.	Houses disin- fected.	Houses fumigated.
	Cubic feet.	Cubic yards.						Cubic feet
1906.								
July.....	..	..	..	..	54,660	25,200	..	1,536,671
August.....	..	..	..	..	56,980	24,240	..	1,614,705
September.....	..	..	..	..	64,670	22,860	..	631,668
October.....	2,025	175	33	390	66,420	21,700	15	331,309
November.....	2,457	141	85	545	76,690	24,030	7	261,210
December.....	4,008	314	140	800	74,160	24,640	8	345,315
1907.								
January.....	..	40	6	8,0	82,800	26,505	9	7,265
February.....	..	117	72	134	81,712	29,260	12	628,820
March.....	..	1	..	11	80,1	11,48	140	1,128,604
April.....	..	..	..	87	80,7	61,640	15	1,111,7
May.....	..	14	..	85	..	..	87	2,11,1
June.....	..	120	..	125	..	60,230	52	1,86,80
Total.....	11,1	1,100	707	7,440	40,672	18,010	365	11,65,000

APPENDIX I.

REPORT OF GENERAL PURCHASING OFFICER.

ISTHMIAN CANAL COMMISSION,
Washington Office, November 5, 1907.

SIR: I have the honor to submit the following report upon the organization and work of the Washington office of the Isthmian Canal Commission during the fiscal year ending June 30, 1907:

Up to March of this year the chairman of the Commission, Mr. Shonts, and Commissioners Endicott, Hains, and Harrod (constituting the engineering committee) made that office their headquarters.

The organization comprised the following divisions. General office, general counsel, auditing, disbursing, appointment, correspondence, record, and purchasing, and in addition quarters were provided for a considerable drafting force connected with the engineering department on the Isthmus. The pay rolls of the office also carried, subject to its supervision, those employees of the Commission engaged in its different branch purchasing offices at New York, New Orleans, San Francisco, and Tacoma.

The general office was charged with the preparation of all general correspondence, the immediate supervision of the divisions of appointment, correspondence, and records, and the care of the building, office fixtures, and supplies.

The general counsel had charge of all legal matters pertaining to the Isthmian Canal Commission and the Panama Railroad Company both in the United States and on the Isthmus of Panama, including the preparation of all contracts, bonds, etc.

The auditing division had to do with the administrative examination of all accounts of United States funds, examinations of all claims receivable and payable in advance of settlement by collecting and disbursing officers, accounts of property, and compilations concerning operation of construction, sanitation, and the other departments under the Commission, as well as with the control and final audit of the accounts of the Panama Railroad and Steamship Company.

The disbursing division was charged with the safe receipt and disbursement of the funds of the Commission, in the United States, upon proper vouchers, and its volume of business amounted to—

Claims:

On hand July 1, 1906.....	171
Received July 1, 1906, to June 30, 1907.....	9, 141
	<hr/>
	9, 312
Passed for settlement July 1, 1906, to June 30, 1907.....	9, 257
	<hr/>
On hand June 30, 1907.....	55

Disbursements.

July 1, 1906, to June 30, 1907.....	\$14,911,596.79
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(These figures include \$3,250,000 paid on account of the Panama Railroad Company, the remainder being for material and supplies, personal service, transportation, cablegrams, etc., for account of the Commission.)

Miscellaneous receipts

Collected and deposited in United States Treasury, July 1, 1906, to June 30, 1907	589,049 04
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Liquidated damages:

Collected for breach of contracts, July 1, 1906, to June 30, 1907.	34 541 19
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The appointment division handled all work of the Washington office in connection with the personnel (other than laborers) of the Isthmian Canal Commission in the United States and elsewhere, including all correspondence and records, appointments and transportation to the Isthmus; arranged return transportation to the Isthmus for employees on leave and members of their families; had supervision over the employment agents, and conducted all correspondence with the Civil Service Commission and made reports thereto.

During the period from July 1, 1906, to June 30, 1907, 4,996 persons within the United States were tendered employment on the Isthmus in grades above that of laborer. Of this number, 3,927 accepted and were accordingly appointed, covering 107 different positions. Of the number who accepted and were appointed, 3,224 persons have been transported to their places of duty (3,021 via New York, 156 via New Orleans, and 47 via San Francisco), the remainder having failed to sail after selection and appointment. Eight hundred and ninety-nine members of families of employees and 1,133 persons returning from leave of absence have been furnished transportation during this period from New York City over the Panama Railroad Company's line of steamers, and a limited number via New Orleans and San Francisco—over 5,300 persons in all having been provided first-class transportation from the United States to the Isthmus during the fiscal year under review.

The work of the correspondence division included all general correspondence, the codifying and deciphering of all cables between the Washington office and the Isthmus, and the mailing of letters and documents from the general office; supervision of the printing of minutes of the meetings of the Commission, the annual report, health reports, etc.

The chief of this division is in charge of all employees connected with the care of the building, including telegraph and telephone operators.

The record division keeps the general records and correspondence of the general office in a form readily accessible for the information of the Secretary of War, Congress, and the officials of the Commission.

The purchasing department of the Commission, under the supervision of the general purchasing officer with headquarters at Washington is charged with the purchase of all equipment, materials, and supplies ordered by the Commission in the United States for use on the Isthmus and elsewhere. Assistant purchasing and shipping agents are located at New York, New Orleans, San Francisco, and Tacoma.

Circulars inviting bids on materials are distributed direct from the offices of the general purchasing officer and assistant purchasing and

shipping agents, and provision is made for distribution of these circulars from the offices of the Engineer Department, and of the Quartermaster's Department, United States Army, and through commercial agencies in certain cities. The published advertisements show where circulars inviting bids may be obtained, and the arrangement made for distribution enables all persons desiring to bid to obtain circulars within a short time after they are issued.

The Commission maintains the practice of calling for bids on materials and supplies delivered on the Isthmus, thereby giving each section of the country equal opportunity in furnishing the materials required, so that the manufacturers, railways, and steamship lines in each locality and through each port may figure on the business on a combination of prices and transportation rates.

The total amount of purchases made by this department during the year ending June 30, 1907, was \$8,759,227.26, the more important items included in this total being 40 mogul freight locomotives, 300 dump cars, 7 steam shovels, 10 earth spreaders, 26 unloaders and unloader plows, 3 20-ton electric cranes, 4 25-ton locomotive cranes, 6 air compressors, 24 rock channelers, 50 rock drills, 45 churn drills, 2 pipe line suction dredges, 1 dipper dredge, 6 steel dump barges, 2 filtration plants, 16,000 tons steel rail, and 36,500,000 feet lumber.

At the close of the fiscal year a change in the organization of the Washington office was in progress, which has resulted in simplifying methods and reducing expenses.

Very respectfully,

H. F. HODGES,
Lieut. Col., Corps of Engineers, U. S. Army,
General Purchasing Officer, Chief of Office.

Lieut. Col. GEORGE W. GOETHALS,
Corps of Engineers, U. S. Army, Chairman and Chief
Engineer, Isthmian Canal Commission, Culebra, Canal Zone.

E 30,

supplies.			Contingent expenses.			Miscellaneous.		
	Washington.	Isthmus.	Total.	Washington.	Isthmus.	Total.		
	530.78	\$145.00	\$4,885.78		\$1,199.60	\$1,199.00		
44	2,538.15		2,538.15	\$280.00		280.00		
	60.65	434.07	500.72					
14	.925.93	579.07	1,346.86	280.00	1,199.60	919.00		
	9,243.67	49.66	29,203.33		216.75	216.75		
	411.65	6.00	417.65					
7	\$1,161.60	236.25	1,397.85		863.77	863.77		
	2,373.52		2,373.52					
9	18,535.40	3,809.31	4,404.71		1,054.86	1,054.86		
	3,798.32		3,798.32					
	4,428.76		24,428.76					
2	171,952.92	4,161.22	66,114.14		1,701.88	1,701.88		
7	142.81	2,700.91	2,843.72		290.87	290.87		
3		238.33	238.33		2,864.67	2,864.67		
		180.00	180.00					
	448.14	775.11	1,223.25					
		20,819.64	20,819.64		4.84	4.84		
		1,054.20	1,054.20		21.90	21.90		
		2,250.34	2,250.34		383.10	383.10		
		6,317.49	6,317.49		8,910.90	8,910.90		
	3.00	310.23	313.23		400.29	400.29		
37		308.38	308.38		28.00	28.00		
		63.19	63.19		722.61	722.61		
		537.92	537.92		2.00	2.00		
		124.35	124.35					
94	593.95	35,689.09	36,283.04		12,183.46	12,183.46		
5		3,944.33	3,944.35					
		15.67	15.67					
161	21.25	5,911.75	5,933.00		43,906.05	43,906.05		
136	21.75	7,911.99	7,933.74		16,084.09	16,084.09		
114		14,742.88	14,742.88		15,569.29	15,569.29		
		8.85	8.85					
3		497.87	497.87		3,335.40	3,335.40		
4		706.45	706.45		4,788.62	4,788.62		
10		3,114.44	3,114.44					
39		17,455.31	17,455.31		1,391.62	1,391.62		
82		27,359.12	27,359.12		6.42	6.42		
		248.65	248.65		968.70	968.70		
	18.00	13.07	4.93					
550	25.00	80,934.64	80,959.64		86,037.35	86,037.35		
	1.00	5,014.18	5,015.18		10.70	10.70		
1546,788.79		5,086.52	51,875.31		6,654.46	6,654.46		
9		644.49	644.49					
5		14.63	14.63					
3046,789.79		10,759.82	57,549.61		6,665.16	6,665.16		

No.		Contingent expenses.			Miscellaneous.		
		Washing- ton.	Isthmus.	Total.	Washing- ton.	Isthmus.	Total.
111	97		\$5,674.25	\$5,674.25		\$78.96	\$78.96
112	94		4.80	4.80		7.50	7.50
113	71		4,582.01	4,582.01		41.04	41.04
114	05		1,588.05	1,588.05		7,225.81	7,225.81
115	96		6,644.19	6,644.19			
116	37		69.02	69.02			
117	00		2,673.22	2,673.22		406.58	406.58
118	33		620.27	620.27		4.03	4.03
119	92		697.01	697.01			
120	23		87.64	87.64			
121	04		1,643.38	1,643.38			
122	68		1,544.55	1,544.55		2.71	2.71
123	66		647.71	647.71			
124	67		1,780.89	1,780.89			
125	74		21.79	21.79			
126	45		48.00	48.00			
127	77		233.43	233.43			
128	68		71.19	71.19		30.29	30.29
129							
130	Cc						
131	91		1,149.18	1,149.18			
132	41		14.19	14.19			
	87		526.46	526.46			
	35		30,321.23	30,321.23		7,578.42	7,578.42
141	01						
142	82		38.66	38.66		43.51	43.51
143	15		839.30	839.30		163.63	163.63
144	83	\$2.70	4,876.30	4,873.60		199.99	199.99
145	23		2,709.42	2,709.42		1,480.18	1,480.18
146	29		326.94	326.94		196.08	196.08
147	22		596.07	596.07		130.10	130.10
148	49		311.69	311.69			
149	72		171.55	171.55		46.37	46.37
150	21		4,023.85	4,023.85			
151	02		243.66	243.66		1,762.49	1,762.49
152	03		658.21	658.21			
	14		11,480.65	11,480.65		5,509.68	5,509.68
	16	2.70	26,285.30	26,282.60		9,532.03	9,532.03
161	27		1,068.26	1,068.26		766.92	766.92
162	17		11,482.84	11,482.84		1.04	1.04
163	11		3,884.26	3,884.36			
164							
165	Me						
166	06		26,897.72	26,897.72		458.18	458.18
167							
168	03		2,398.72	2,398.72		41.98	41.98
169	15		5,672.30	5,672.30		4,925.79	4,925.79
170	50		23,926.94	23,926.94		1,030.20	1,030.20
171	79		20,966.18	20,966.18		654.00	654.00
	08		96,207.32	96,207.32		6,565.11	6,565.11

a.	Contingent expenses.			Miscellaneous.			
	Total.	Washing- ton.	Isthmus.	Total.	Washing- ton.	Isthmus.	Total.
	\$18,589.64	\$115.00	\$3,795.46	\$3,910.46		\$944.86	\$944.86
	23,524.44	73.95	132.86	206.81			
	521,536.79		43,353.77	43,353.77		1,197.75	1,197.75
	61,630.41		1,253.61	1,253.61		9,082.71	9,082.71
	157,163.75		11,719.61	11,719.61		888.99	888.99
	34,443.54		2,411.10	2,411.10			
	43,760.08		12,617.19	12,617.19			
	19,519.98		33,276.52	33,276.52		420.71	420.71
	51,082.98		8,011.30	8,011.30			
	10,886.70		223.56	223.56		861.58	861.58
	107,820.71		117,981.51	117,981.51		761.07	761.07
	16,107.03		71,457.68	71,457.68		27.32	27.32
			11,449.17	11,449.17		11,095.00	11,095.00
	21,870.12		20,191.76	20,191.76			
	35,006.67	7.65	7,342.26	7,349.91		117.50	117.50
	3,912.45		1,655.08	1,655.08			
	7,951.53		1,125.04	1,125.04			
			482.18	482.18			
	2,289.77		1,087.82	1,087.82			
	383.48		146.03	146.03			
	23,162.08		3,065.28	3,065.28			
	82.19		84.41	84.41			
	90.84		138.17	138.17			
	25.62		55.21	55.21			
	1,401.94						
	262,802.74	196.60	353,056.58	353,253.18		949.85	949.85
	174,772.67	46,983.69	516,720.25	563,703.94		81,290.57	81,290.57
	122,834.90		387.46	387.46		15,788.19	15,788.19
		475.81	5,663.60	5,187.79		8,799.56	8,799.56
	205,594.86		17,369.81	17,369.81		125.03	125.03
	514,054.31		2,503.27	2,503.27		2,278.99	2,278.99
	17,536.01	7,368.53	385.34	7,753.87		26.21	26.21
	299,019.23		170.32	170.32			
	418,568.65		30.00	30.00		18,122.55	18,122.55
	243,370.61		77.68	77.68		19,025.65	19,025.65
	224,257.01	4.80	16,138.06	16,133.26		18,420.78	18,420.78
	141,139.19		4,267.87	4,267.87		8,588.25	8,588.25
	165.40		153.63	153.63			
	244,753.18		59,607.31	59,607.31		19,813.56	19,813.56
	88,415.04		4,914.10	4,914.10		52,885.40	52,885.40
	483,783.15		2,982.17	2,982.17		972,506.52	972,506.52
	12,696.53		1,941.78	1,941.78			
	13,146.06		373.28	373.28			
	33,958.61		305.00	305.00		61.42	61.42
	26.44						
	8,478.75					15.52	15.52
	171,797.93	7,839.54	105,943.48	113,783.02		1,077,220.11	1,077,220.11
	962.56	1,925.93	579.07	1,346.86	\$280.00	1,199.60	919.60
	15,268.07	61,952.92	4,161.22	66,114.14		1,701.88	1,701.88
	90,042.37	503.95	35,689.09	36,283.04		12,183.46	12,183.46
	59,876.35	25.00	80,934.64	80,959.64		86,037.35	86,037.35
	174,772.67	46,983.69	516,720.25	563,703.94		81,290.57	81,290.57
	171,797.93	7,839.54	105,943.48	113,783.02		1,077,220.11	1,077,220.11
	2,719.95	115,469.17	744,027.75	859,496.92	280.00	1,207,233.77	1,207,513.77

No.	Contingent expenses.			Miscellaneous.		
	Washing- ton.	Isthmus.	Total.	Washing- ton.	Isthmus.	Total.
1	2.54	\$58.05	\$58.65		\$3,783.87	\$3,783.87
2	5.67				552.36	552.36
3	0.05				809.93	809.93
4	5.65				61.57	61.57
5	1.06	32.12	32.12			
6	1.70	.20	.20			
7	1.22	54.70	54.70		16.33	16.33
8	1.71					
9	1.75	292.59	292.59			
10	1.45				8.75	8.75
11	1.87				1,940.68	1,940.68
12	1.89	1,360.64	1,360.64		300.00	300.00
13	1.41					
	1.23	1,798.90	1,798.90		6,873.49	6,873.49
1	3.66	\$13,381.59	13,381.59			
2	4.53	2,739.45	2,739.45			
3		195.77	195.77			
4		317.10	317.10			
5		25,522.56	25,522.56			
6	5.19	591.13	37,666.67		27,802.52	27,862.52
7	4.40	92,856.77	323,821.74		110.26	110.26
8	1.60	135,604.37	361,488.41		27,752.26	27,752.26
			497,092.78			

H. L. STUNTZ, *Local Auditor.*

CANAL ZONE, *August 7, 1907.*

APPENDIX K.

ESTIMATE OF APPROPRIATIONS FOR 1908-9.

To continue the construction of a canal connecting the Atlantic and Pacific oceans	\$28,906,896 00
Health and sanitation	2,175,190 60
Canal Zone government	688,320 00
Expenses in the United States	198,797 00
Total	31,969,203 60
Supplemental estimate for equipment of Panama Railroad submitted October 17, 1907	1,213,940 00
	33,183,143 60

Estimate of appropriations required to continue the construction of the Isthmian Canal during the fiscal year ending June 30, 1909, compared with appropriations for fiscal year ending June 30, 1908.

Item	Estimate 1909	Appropriation, 1908.
1. For salaries of officers and employees of the Isthmian Canal Commission, including assistant purchasing and shipping agents and all other employees in the United States	\$145,422 00	\$184,000 00
2. For incidental expenses including rents, cable and telegraph service, supplies, stationery, and actual necessary traveling expenses in the United States including rent of the Panama Canal building, in the District of Columbia, \$7,500, and text-books and books of reference, \$1,000	53,375 00	69,000 00
3. For pay of members of the Commission and officers and employees on the Isthmus, other than skilled and unskilled labor including civil engineers, superintendents, instrumentmen, transitmen, levelmen, rodmen, draftsmen, timekeepers, mechanical and electrical engineers, supervisors, clerks, accountants, stenographers, storekeepers, messengers, office boys, foremen and subforemen, watchmen, wage masters, stewards, hospital dispensers, internes, nurses and attendants, including those necessary and temporarily detailed for duty away from the Isthmus, for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence	3,517,911 00	2,772,000 00
4. For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brickmen, electricians, teamsters, crane-men, machinists, blacksmiths, and other artisans and their helpers, painters, sailors, cooks, waiters, and barymen for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence	11,429,847 00	7,900,000 00
5. For purchase and delivery of material, supplies and equipment including cost of inspecting material and of paying traveling expenses incurred thereto, whether on the Isthmus or elsewhere and such other expenses not in the United States as the Commission deems necessary to best promote the construction of the Isthmian Canal for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters, and subsistence	11,752,704 00 *1,750,000 00	9,046,000 00 1,885,000 00
6. For construction of new Panama R. R.		
7. For miscellaneous expenditures, cable and telegraph service, stationery and printing, and traveling and incidental expenses on the Isthmus for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence	456,430 00	558,000 00
8. For pay of officers and employees other than skilled and unskilled labor in the service of the government of the Canal Zone	496,460 00	480,000 00
9. For skilled and unskilled labor in the service of the government of the Canal Zone	73,360 00	50,000 00
10. For material, supplies, equipment, new buildings, and contingent expenses for account of the government of the Canal Zone.	118,500 00	289,000 00

Estimate of appropriations required to continue the construction of the Isthmian Canal during the fiscal year ending June 30, 1909, etc.—Continued.

Item.	Estimate, 1909.	Appropriation, 1908.
11. For pay of officers and employees other than skilled and unskilled labor engaged in the sanitation department on the Isthmus	\$784,796.00	\$706,000.00
12. For skilled and unskilled labor engaged in the sanitation department on the Isthmus	667,003.80	468,000.00
13. For material, supplies, equipment, new buildings, and contingent expenses of the sanitation department on the Isthmus	743,400.80	800,000.00
Total	31,969,203.60	27,161,367.50
Supplemental estimate (under item No. 6) for equipment of Panama R. R., submitted Oct. 17, 1907.	1,213,946.00	
Grand total	33,183,149.60	

*The amount shown under the head of "Appropriation, 1908" was for the "equipment and construction of the Panama Railroad," while for the "Estimate, 1909" the amount includes the construction only, the estimate for equipment being covered under a "Supplemental estimate."

NOTES

[Estimates referred to are distributed among items 3, 4, 5, and 7.]

Estimates of the requirements of the Colon dredging division (extending from the Atlantic Ocean to Gatun locks) are based upon the operation of 2 French ladder dredges, 2 dipper dredges, and 1 sea-going suction dredge, together with necessary tug and clamet service, operation of dry dock and marine shop and excavation by 2 steam shovels.

Estimates of the requirements of the La Boca dredging division (extending from Pedro Miguel to Pacific Ocean) are based upon the operation of 2 ladder dredges, 1 dipper dredge, 1 sea-going suction dredge, 2 steam launchers, 7 clamets, shipways, and machine shops.

Construction of proposed new dry dock and shop are not included, as it is assumed that the cost of these will be paid for from subsequent appropriation.

Estimates of the requirements of the department of labor, quarters, and subsistence are based upon the assumption that the act of March 4, 1907, providing for deductions from the pay of employees for transportation, board, supplies, and other service, will remain in force.

Detailed estimate of appropriations, by items, required to continue the construction of the Isthmian Canal during the fiscal year ending June 30, 1909

To continue the construction of the Isthmian Canal, to be expended under the direction of the President, in accordance with an act entitled "An act to provide for the construction of a canal connecting the waters of the Atlantic and Pacific oceans," approved June 28, 1902 \$31,969,203.60

ITEM 1

For salaries of officers and employees of the Isthmian Canal Commission, including assistant purchasing and shipping agents, and all other employees in the United States \$145,422.00

Office of the general counsel	
1 general counsel, at \$8,000	8,000.00
1 law clerk, at \$2,800	2,800.00
1 clerk, at \$1,200	1,200.00
Office of the construction	
1 chief engineer, at \$3,600	3,600.00
1 chief of division, at \$2,200	2,250.00
2 chiefs of division, at \$2,000	4,000.00
1 clerk, at \$1,800	1,800.00
1 clerk, at \$1,600	8,000.00
1 shipping and property clerk, at \$1,600	1,600.00
1 clerk, at \$1,400	1,500.00
1 clerk, at \$1,400	5,600.00
3 clerks, at \$1,200	3,600.00
1 clerk, at \$1,000	3,000.00
1 clerk, at \$800	2,700.00
1 telephone operator, at \$1,400	1,400.00
1 telephone operator, at \$600	600.00
1 porter, at \$2,500	2,500.00
1 messenger, at \$600	1,800.00
1 messenger, at \$180	1,920.00

REPORT ISTHMIAN CANAL COMMISSION.

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Custodian's force:

1 engineer and electrician, at \$1,400.....	\$1, 400. 00
1 head watchman, at \$840.....	840. 00
2 watchmen, at \$720.....	1, 440. 00
1 watchman-messenger-fireman, at \$720.....	720. 00
1 elevator conductor, at \$720.....	720. 00
2 laborers, at \$600.....	1, 200. 00
1 head charwoman, at \$300.....	300. 00
4 charwomen, at \$240.....	960. 00

Office of general purchasing officer:

1 chief clerk, at \$3,600.....	3, 600. 00
1 clerk, at \$1,800.....	1, 800. 00
1 clerk at \$1,500.....	1, 500. 00
3 clerks, at \$1,400.....	4, 200. 00
4 clerks, at \$1,200.....	4, 800. 00
2 clerks, at \$1,000.....	2, 000. 00
5 clerks, at \$900.....	4, 500. 00
1 messenger, at \$600.....	600. 00
1 messenger, at \$420.....	420. 00
1 messenger, at \$360.....	360. 00
Temporary clerks for special service.....	900. 00

Office of disbursing officer:

1 disbursing officer, at \$5,000.....	5, 000. 00
1 chief clerk, at \$2,400.....	2, 400. 00
1 clerk, at \$1,800.....	1, 800. 00
2 clerks, at \$1,600.....	3, 200. 00
6 clerks, at \$1,400.....	8, 400. 00
3 clerks, at \$1,200.....	3, 600. 00
3 clerks, at \$1,000.....	3, 000. 00
1 clerk, at \$900.....	900. 00
1 messenger, at \$840.....	840. 00
1 messenger, at \$720.....	720. 00

Office of assistant examiner of accounts:

1 assistant examiner of accounts, at \$3,600.....	3, 600. 00
1 chief clerk, at \$2,000.....	2, 000. 00
1 clerk, at \$1,600.....	1, 600. 00
1 clerk, \$1,400.....	1, 400. 00

Office of assistant purchasing agent, New York:

1 assistant purchasing agent, at \$3,000.....	\$3, 000
1 chief clerk, at \$1,500.....	1, 500
1 clerk, at \$1,380.....	1, 380
1 clerk, at \$1,200.....	1, 200
1 clerk, at \$936.....	936
2 clerks, at \$900.....	1, 800
1 inspector, at \$960.....	960
1 clerk, at \$840.....	840
1 clerk, at \$720.....	720
1 clerk, at \$480.....	480
1 messenger, at \$360.....	360
1 messenger, at \$300.....	300
1 warehouseman, at \$900.....	900

14, 376

By resolution of the Isthmian Canal Commission, adopted
November 9, 1905, the Commission paid one-third of the
above salaries

4, 792. 00
2, 200. 00

Office of assistant purchasing agent, New Orleans:

1 assistant purchasing agent, at \$2,200.....	2, 200. 00
1 clerk, at \$1,000.....	1, 000. 00
1 messenger, at \$480.....	480. 00

Office of assistant purchasing agent, Tacoma:

1 assistant purchasing agent, at \$2,000.....	2, 000. 00
1 clerk, at \$900.....	900. 00

Office of inspecting engineer at New York:

1 inspecting engineer, at \$3,600.....	\$3,600
1 assistant inspecting engineer, at \$1,920.....	1,920
1 clerk, at \$1,040.....	1,040
1 clerk, at \$1,000.....	1,000
1 clerk, at \$960.....	960
1 clerk, at \$780.....	780
1 clerk, at \$480.....	480

9,780

By resolution of the Isthmian Canal Commission, adopted
November 9, 1905, the Commission pays one-third of
above salaries

\$3,260.00

Total item 1 145,422.00

ITEM 2.

For incidental expenses, including rents, cable and telegraph service,
supplies, stationery and actual necessary traveling expenses in the
United States (including rent of the Panama Canal building in the
District of Columbia, \$7,500, and text-books and books of reference,
\$1,000).....

\$53,375.00

For rent of buildings in the United States (including the Panama
Canal Building in the District of Columbia, \$7,500)

9,700.00

Traveling expenses of officers and employees of the Commission in the
United States.....

5,150.00

Fuel, light, and power.....

2,300.00

Telegrams, cablegrams, and telephones.....

18,000.00

Stationery and miscellaneous office supplies, including typewriters
and repairs to the same, text-books, and books of reference.....

8,000.00

Advertising by newspapers and posters.....

6,950.00

Incidental expenses of administration.....

3,075.00

Total item 2 53,375.00

ITEM 3

For pay of members of the Commission and officers and employees
on the Isthmus, other than skilled and unskilled labor, including
civil engineers, superintendents, instrumentmen, transmitters,
levelers, draftsmen, timekeepers, mechanical and elec-
trical engineers, supervisors, clerks, accountants, stenographers,
storekeepers, messengers, office boys, foremen and subforemen,
watchmen, wagon masters, stewards, hospital dispensers, nurses,
and attendants, including those necessary and tempora-
rily detailed for duty away from the Isthmus, for the departments of
construction and engineering, disbursing, examination of accounts
and for quarters and subsistence.....

\$3,517,911.00

Construction and engineering department

1 chief engineer.....	11,000.00
10 assistants, at \$10,000 supervisory engineers.....	21,000.00
10 assistants, at \$8,000 supervisory engineers.....	11,000.00
10 assistants, at \$6,000 supervisory engineers.....	10,000.00
10 assistants, at \$4,000 supervisory engineers.....	3,600.00
10 assistants, at \$3,000.....	3,600.00
10 assistants, at \$2,000.....	9,000.00
10 assistants, at \$1,500.....	8,400.00
10 assistants, at \$1,000.....	21,000.00
10 assistants, at \$800.....	16,800.00
10 assistants, at \$700.....	1,050.00
10 assistants, at \$600.....	2,400.00
10 assistants, at \$500.....	10,000.00
10 assistants, at \$400.....	3,000.00
10 assistants, at \$300.....	2,100.00
10 assistants, at \$200.....	2,400.00
10 assistants, at \$100.....	33,600.00

Construction and engineering department—Continued.

73 clerks, at \$1,800.....	\$131,400.00
138 clerks, at \$1,500.....	207,000.00
34 clerks, at \$1,200.....	40,800.00
3 clerks, at \$1,000.....	3,000.00
29 clerks, at \$900.....	26,100.00
3 clerks, at \$840.....	2,520.00
2 clerks, at \$720.....	1,440.00
2 clerks, at \$600.....	1,200.00
2 clerks, at \$480.....	960.00
1 clerk, at \$450.....	450.00
1 inspector, at \$3,300.....	3,300.00
1 inspector, at \$2,700.....	2,700.00
1 inspector, at \$2,400.....	2,400.00
2 inspectors, at \$2,100.....	4,200.00
5 inspectors, at \$1,800.....	9,000.00
1 inspector, at \$1,200.....	1,200.00
3 inspectors, at \$900.....	2,700.00
1 draftsman, at \$3,000.....	3,000.00
1 draftsman, at \$2,700.....	2,700.00
1 draftsman, at \$2,400.....	2,400.00
5 draftsmen, at \$2,100.....	10,500.00
14 draftsmen, at \$1,800.....	25,200.00
18 draftsmen, at \$1,500.....	27,000.00
4 draftsmen, at \$1,200.....	4,800.00
1 draftsman, at \$1,000.....	1,000.00
1 tracer, at \$1,200.....	1,200.00
1 tracer, at \$900.....	900.00
9 instrumentmen, at \$2,100.....	18,900.00
11 transitmen, at \$1,800.....	19,800.00
22 levelmen, at \$1,500.....	33,000.00
15 levelmen, at \$1,200.....	18,000.00
4 rodmen, at \$1,200.....	4,800.00
22 rodmen, at \$1,000.....	22,000.00
• 5 rodmen, at \$900.....	4,500.00
1 observer, at \$1,200.....	1,200.00
1 photographer, at \$2,100.....	2,100.00
1 photographer's helper, at \$480.....	480.00
1 general secretary, clubhouses, at \$2,400.....	2,400.00
4 secretaries, clubhouses, at \$1,800.....	7,200.00
2 assistant secretaries, clubhouses, at \$1,500.....	3,000.00
3 telegraph operators, at \$1,500.....	4,500.00
12 telephone operators, at \$720.....	8,640.00
3 messengers, at \$600.....	1,800.00
3 messengers, at \$480.....	1,440.00
4 messengers, at \$450.....	1,800.00
2 messengers, at \$420.....	840.00
4 messengers, at \$360.....	1,440.00
3 messengers, at \$300.....	900.00
2 messengers, at \$270.....	540.00
1 messenger, at \$240.....	240.00
1 messenger, at \$210.....	210.00
1 office boy, at \$240.....	240.00
6 division engineers, at \$7,500.....	45,000.00
1 division engineer, at \$6,600.....	6,600.00
2 division engineers, at \$5,000.....	10,000.00
1 division engineer, at \$3,500.....	3,500.00
1 assistant division engineer, at \$6,000.....	6,000.00
1 office engineer, at \$4,800.....	4,800.00
1 assistant engineer, at \$4,000.....	4,000.00
8 assistant engineers, at \$3,000.....	24,000.00
4 assistant engineers, at \$2,700.....	10,800.00
4 assistant engineers, at \$2,400.....	9,600.00
1 designing engineer, at \$8,000.....	8,000.00
1 designing engineer, at \$7,500.....	7,500.00
1 designing engineer, at \$6,000.....	6,000.00
1 designing engineer, at \$3,600.....	3,600.00
1 mechanical engineer, at \$5,000.....	5,000.00

Construction and engineering department—Continued.

6 resident engineers, at \$3,600.....	\$21, 600. 00
1 resident engineer, at \$4,000.....	4, 000. 00
1 resident engineer, at \$3,300.....	3, 300. 00
1 superintendent transportation, at \$5,000.....	5, 000. 00
1 superintendent transportation at \$2,100.....	2, 100. 00
1 assistant superintendent transportation, at \$3,000.....	3, 000. 00
1 superintendent, at \$4,200.....	4, 200. 00
1 superintendent, at \$4,000.....	4, 000. 00
9 superintendents, at \$3,600.....	32, 400. 00
2 superintendents, at \$3,300.....	6, 600. 00
7 superintendents, at \$3,000.....	21, 000. 00
1 superintendent, at \$3,000 (10 months).....	2, 500. 00
2 superintendents, at \$3,000 (6 months).....	3, 000. 00
8 superintendents, at \$2,700.....	21, 600. 00
2 superintendents, at \$2,400.....	4, 800. 00
1 superintendent, at \$2,100.....	2, 100. 00
6 assistant superintendents, at \$3,000.....	18, 000. 00
1 supervisor, at \$3,600.....	3, 600. 00
1 supervisor, at \$3,000.....	3, 000. 00
1 supervisor, at \$2,640.....	2, 640. 00
1 supervisor at \$2,400.....	2, 400. 00
1 supervisor, at \$2,400 (6 months).....	1, 200. 00
7 supervisors, at \$2,100.....	14, 700. 00
1 supervisor, at \$2,100 (10 months).....	1, 750. 00
1 foreman, at \$3,000.....	3, 000. 00
1 foreman, at \$2,400.....	2, 400. 00
40 foremen, at \$2 100.....	84, 000. 00
2 foremen, at \$2,040.....	4, 080. 00
148 foremen, at \$1,800.....	266, 400. 00
4 foremen, at \$1,800 (10 months).....	6, 000. 00
7 foremen, at \$1,800 (6 months).....	6, 300. 00
147 foremen, at \$1,500.....	220, 500. 00
4 foremen, at \$1,500 (10 months).....	5, 000. 00
8 foremen, at \$1,500 (6 months).....	6, 000. 00
2 foremen, at \$1,680.....	3, 360. 00
91 foremen, at \$1,200.....	109, 200. 00
1 foreman, at \$1,200 (10 months).....	4, 000. 00
1 foreman, at \$1,200 (6 months).....	2, 400. 00
24 foremen, at \$1,000.....	24, 000. 00
24 foremen, at \$900.....	26, 100. 00
7 foremen, at \$840.....	5, 880. 00
1 foreman, at \$750.....	750. 00
16 foremen, at \$720.....	11, 520. 00
42 foremen, at \$600.....	25, 200. 00
1 foreman, at \$480.....	480. 00
10 foremen, at \$450.....	4, 500. 00
18 foremen, at \$384.....	6, 912. 00
2 foremen, at \$360.....	720. 00
1 trainmaster, at \$3,000.....	3, 000. 00
1 trainmaster, at \$2,700.....	2, 700. 00
24 yardmasters, at \$2,520.....	60, 480. 00
1 master, at \$3,000.....	3, 000. 00
2 masters, at \$2,520.....	5, 040. 00
1 master, at \$2,400.....	2, 400. 00
2 masters, at \$1,800.....	3, 600. 00
9 masters, at \$1,200.....	10, 800. 00
2 masters, at \$1,180.....	2, 360. 00
16 masters, at \$960.....	15, 360. 00
21 masters, at \$800.....	1, 800. 00
9 masters, at \$850.....	7, 650. 00
2 masters, at \$750.....	4, 500. 00
2 masters, at \$1,200.....	2, 400. 00
12 truck drivers, at \$2,100.....	25, 200. 00
8 accountants, at \$1,800.....	14, 400. 00
21 peckkeepers, at \$2,400.....	4, 800. 00
60 peckkeepers, at \$2,400.....	8, 400. 00
1 truck keeper, at \$2,100 one half.....	1, 050. 00

Construction and engineering department—Continued.

5 timekeepers, at \$1,800.....	\$9,000.00
13 timekeepers, at \$1,500.....	19,500.00
50 timekeepers, at \$1,200.....	60,000.00
1 timekeeper, at \$1,080.....	1,080.00
6 timekeepers, at \$900.....	5,400.00
1 timekeeper, at \$720.....	720.00
3 timekeepers, at \$600.....	1,800.00
5 timekeepers, at \$450.....	2,250.00
1 watchman, at \$1,200.....	1,200.00
8 watchmen, at \$900.....	7,200.00
8 watchmen, at \$720.....	5,760.00
4 watchmen, at \$600.....	2,400.00
2 watchmen, at \$480.....	960.00
7 watchmen, at \$450.....	3,150.00
9 watchmen, at \$390.....	3,510.00
6 watchmen, at \$360.....	2,160.00
1 storekeeper, at \$3,000.....	3,000.00
3 storekeepers, at \$2,500.....	7,500.00
1 storekeeper, at \$2,400.....	2,400.00
1 storekeeper, at \$2,100.....	2,100.00
2 storekeepers, at \$1,800.....	3,600.00
1 storekeeper, at \$1,500.....	1,500.00
1 storekeeper, at \$1,000.....	1,000.00
6 storemen, at \$1,200.....	7,200.00
7 storemen, at \$900.....	6,300.00
3 storemen, at \$600.....	1,800.00
1 storeman, at \$420.....	420.00
1 storeman, at \$384.....	384.00
2 stockmen, at \$1,500.....	3,000.00
2 stockmen, at \$1,200.....	2,400.00
1 checker, at \$1,080.....	1,080.00
6 checkers, at \$900.....	5,400.00
6 checkers, at \$750.....	4,500.00
15 checkers, at \$600.....	9,000.00
2 checkers, at \$540.....	1,080.00
1 checker, at \$480.....	480.00
1 checker, at \$450.....	450.00
25 checkers, at \$384.....	9,600.00
1 superintendent motive power, at \$7,500.....	7,500.00
1 master car builder, at \$3,600.....	3,600.00
1 master builder, at \$6,000.....	6,000.00
1 assistant master builder, at \$3,600.....	3,600.00
1 architect, at \$3,600.....	3,600.00
1 secretary to supervisory engineer, at \$3,600.....	3,600.00
1 stenographer, at \$1,800.....	1,800.00
1 stenographer, at \$1,500.....	1,500.00
2 cement testers, at \$1,800.....	3,600.00
1 stationer and printer, at \$2,400.....	2,400.00
1 typewriter repair man, at \$1,800.....	1,800.00
1 typewriter repair man, at \$1,500.....	1,500.00
1 veterinary surgeon, at \$2,100.....	2,100.00
1 assistant veterinary surgeon, at \$1,500.....	1,500.00
2 wagon masters, at \$600.....	1,200.00
Draftsman, office superintendent locks and dams.....	13,000.00
To provide for necessary increase of force and adjustment of compensation.....	148,240.00
Miscellaneous employees.....	281,900.00
Division of meteorology and river hydraulics—	
General office—	
Division engineer.....	\$4,200
Clerical.....	7,920
Technical—	
Hydrographic.....	\$6,800
Meteorological.....	3,300
	<hr/> 10,100
	<hr/> 22,220.00

Construction and engineering department—Continued.

Division of meteorology and river hydraulics—Continued.

Hydrographic stations—

Alhajuela.....	\$2,910
Gamboa.....	600
Lower Chagres district	
District hydrographer.....	\$1,800
Surveyor.....	1,200
Gatun (3 stations).....	5,410
Trinidad.....	1,980
Gatuncillo.....	2,080
Bohio.....	2,070
	<hr/> 14,540

\$18,050.00

Meteorological stations—

Naoa, Ancón, or La Boca—	
1 station (1 year).....	2,160
1 station (3 months).....	450
Bas Obispo (possibly 2 men).....	3,000
Cristobal.....	2,800
	<hr/> 8,410.00

Total construction and engineering department . . . 2,939,336.00

Disbursement department:

1 disbursing officer, at \$10,000.....	10,000.00
1 assistant disbursing officer, at \$4,000.....	4,000.00
1 secretary to disbursing officer, at \$2,000.....	2,000.00
1 bookkeeper (bonded), at \$2,125.....	2,125.00
1 bookkeeper, at \$1,800.....	1,800.00
1 cashier, at \$3,600.....	3,600.00
3 paymasters, at \$2,500.....	7,500.00
2 pay clerks at \$1,200.....	4,400.00
2 pay clerks at \$2,100.....	4,200.00
2 pay clerks at \$2,000.....	4,000.00
2 pay clerks at \$1,800.....	3,700.00
1 paymaster at \$1,800.....	1,800.00
2 book clerks at \$1,800.....	3,600.00
2 stenographers and typewriters at \$1,800.....	3,600.00
7 stenographers and typewriters at \$1,500.....	10,500.00
1 clerk at \$2,100.....	9,600.00
1 pay clerk at \$1,500.....	2,300.00
1 clerk at \$2,200.....	2,200.00
6 clerks at \$2,100.....	12,600.00
6 clerks at \$2,000.....	12,000.00
24 clerks at \$1,800.....	43,200.00
1 clerk at \$1,500.....	55,500.00
2 clerks at \$1,500.....	34,800.00
1 clerk at \$1,500.....	1,000.00
1 clerk at \$1,500.....	1,800.00
1 clerk at \$1,500.....	3,120.00
8 clerks at \$1,200.....	5,760.00
1 clerk at \$1,200.....	1,200.00
1 clerk at \$1,200.....	900.00
1 clerk at \$1,200.....	840.00
1 clerk at \$1,200.....	2,880.00
1 clerk at \$1,200.....	600.00
2 clerks at \$1,200.....	960.00
1 clerk at \$1,200.....	360.00
	<hr/> 258,495.00

Total

1 clerk at \$1,000.....	4,000.00
1 clerk at \$1,500.....	2,700.00
1 clerk at \$1,500.....	2,100.00
2 clerks at \$1,800.....	3,600.00
1 clerk at \$1,500.....	2,100.00

Examination of accounts—Continued.

1 accountant, at \$1,800.....	\$1,800.00
1 accountant, at \$1,500.....	1,500.00
2 accountants, at \$1,200.....	2,400.00
1 accountant, at \$2,000.....	2,000.00
1 accountant, at \$1,800.....	1,800.00
1 accountant, at \$2,000.....	2,000.00
1 accountant, at \$1,500.....	1,500.00
1 messenger, at \$480.....	480.00
1 inspector and member of board of survey, at \$2,400.....	2,400.00
2 inspectors, at \$2,100.....	4,200.00
1 inspector, at \$1,800.....	1,800.00
1 chief time inspector, at \$2,400.....	2,400.00
6 time inspectors, at \$1,800.....	10,800.00
10 time inspectors, at \$1,600.....	16,000.00
10 time inspectors, at \$1,500.....	15,000.00
15 time inspectors, at \$1,400.....	21,000.00
15 time inspectors, at \$1,200.....	18,000.00
Total examination of accounts.....	119,580.00

Labor, quarters, and subsistence department:

1 commissioner (manager labor and quarters).....	10,000.00
1 assistant manager, at \$4,000.....	4,000.00
4 superintendents, at \$3,000.....	12,000.00
3 labor agents, at \$3,600.....	10,800.00
3 labor agents, at \$5,400.....	16,200.00
1 chief clerk, at \$3,000.....	3,000.00
4 supervisors, at \$2,400.....	9,600.00
4 supervisors, at \$2,100.....	8,400.00
2 supervisors, at \$1,800.....	3,600.00
4 assistant supervisors, at \$1,500.....	6,000.00
4 assistant supervisors, at \$1,200.....	4,800.00
4 clerks, at \$2,100.....	8,400.00
15 clerks, at \$1,800.....	27,000.00
20 clerks, at \$1,500.....	30,000.00
6 clerks, at \$1,200.....	7,200.00
4 copyists, at \$1,000.....	4,000.00
1 timekeeper, at \$1,500.....	1,500.00
6 timekeepers, at \$1,200.....	7,200.00
5 timekeepers, at \$1,000.....	5,000.00
6 furniture repairers, at \$1,500.....	9,000.00
2 foremen, at \$1,000.....	2,000.00
7 foremen, at \$1,200.....	8,400.00
1 interpreter, at \$1,200.....	1,200.00
1 operator, at \$1,200.....	1,200.00

Total labor, quarters, and subsistence department..... 200,500.00

Total item 3..... 3,517,911.00

ITEM 4.

For skilled and unskilled labor on the Isthmus, including engineers, conductors, firemen, brakemen, electricians, teamsters, cranesmen, machinists, blacksmiths, and other artisans and their helpers, janitors, sailors, cooks, waiters, and dairymen, for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters, and subsistence..... \$11,429,847.00

Construction and engineering department:

9 axmen, at \$360.....	3,240.00
2 axmen, at \$300.....	600.00
10 blacksmiths, at \$1,800.....	18,000.00
7 blacksmiths, at \$1,620.....	11,340.00
2 blacksmiths, at \$1,500.....	3,000.00
3 blacksmiths, at \$1,200.....	3,600.00
1 blacksmith, at \$768.....	768.00
1 blacksmith, at \$720.....	720.00
3 blacksmiths, at \$600.....	1,800.00

Construction and engineering department—Continued.

[illegible]

Construction and engineering department—Continued.

2 helpers, at \$480.....	\$960. 00
1 helper, at \$420.....	420. 00
1 helper, at \$360.....	360. 00
1 helper, at \$300.....	300. 00
1 horseshoer, at \$600.....	600. 00
1 janitor, at \$480.....	480. 00
1 janitor, at \$360.....	360. 00
3 levermen, at \$2,220.....	6, 660. 00
1 lithographer, at \$1,500.....	1, 500. 00
2 machinists, at \$2,100.....	4, 200. 00
6 oilers, at \$900.....	5, 400. 00
4 oilers, at \$720.....	2, 880. 00
5 oilers, at \$660.....	3, 300. 00
3 oilers, at \$540.....	1, 620. 00
1 oilman, at \$600.....	600. 00
1 oilman, at \$420.....	420. 00
10 packers, at \$300.....	3, 000. 00
1 painter, at \$840.....	840. 00
2 painters, at \$480.....	960. 00
2 paper cutters, at \$384.....	768. 00
1 pipefitter, at \$1, 500.....	1, 500. 00
2 pipefitters, at \$1, 200.....	2, 400. 00
5 pipefitters, at \$600.....	3, 000. 00
7 pipe-line men, at \$1,200.....	8, 400. 00
50 pipe-line men, at \$450.....	22, 500. 00
28 powdermen, at \$1,800.....	50, 400. 00
17 powdermen, at \$1,500.....	25, 500. 00
10 powdermen, at \$1,200.....	12, 000. 00
1 pressman, at \$780.....	780. 00
1 pressman, at \$750.....	750. 00
2 pressmen, at \$720.....	1, 440. 00
6 pressmen, at \$600.....	3, 600. 00
1 pressman, at \$528.....	528. 00
1 pressman's assistant, at \$600.....	600. 00
2 pressman's assistants, at \$456.....	912. 00
5 pumpmen, at \$1,620.....	8, 100. 00
5 pumpmen, at \$1,500.....	7, 500. 00
2 pumpmen, at \$1,000.....	2, 000. 00
4 pumpmen, at \$900.....	3, 600. 00
3 pumpmen, at \$720.....	2, 160. 00
5 pumpmen, at \$600.....	3, 000. 00
2 saddlers, at \$600.....	1, 200. 00
2 saddlers, at \$480.....	960. 00
31 sailors, at \$540.....	16, 740. 00
12 sailors, at \$480.....	5, 760. 00
43 sailors, at \$450.....	19, 350. 00
24 sailors, at \$360.....	8, 640. 00
1 stableman, at \$720.....	720. 00
1 stableman, at \$540.....	540. 00
4 stablemen, at \$480.....	1, 920. 00
5 stablemen, at \$420.....	2, 100. 00
19 stablemen, at \$360.....	6, 840. 00
1 stampmaker, at \$600.....	600. 00
1 switchman, at \$480.....	480. 00
11 teamsters, at \$540.....	5, 940. 00
137 teamsters, at \$480.....	65, 760. 00
18 teamsters, at \$420.....	7, 560. 00
148 trainmen, at \$1,200.....	177, 600. 00
1 trimmer, at \$720.....	720. 00
2 waiters, at \$240.....	480. 00
3 water-service men, at \$1,500.....	4, 500. 00
2 winchmen, at \$720.....	1, 440. 00
2 winchmen, at \$660.....	1, 320. 00
12 winchmen, at \$600.....	7, 200. 00
16 winchmen, at \$540.....	8, 640. 00
Laborers, skilled and unskilled.....	8, 746, 167. 00

Total construction and engineering department..... 11, 128, 947. 00

Disbursement department:

2 janitors, at \$450.....	\$900. 00
Labor, quarters, and subsistence department:	
Unskilled labor.....	300,000 00
Total item 4	11,429,847. 00

ITEM 5.

For purchase and delivery of material, supplies, and equipment, including cost of inspecting material and of paying traveling expenses incident thereto, whether on the Isthmus or elsewhere, and such other expenses not in the United States as the Commission deems necessary to best promote the construction of the Isthmian Canal, for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters, and subsistence..... \$11,752,708. 00

New equipment:

La Boca dredging division—	
Machinery and appliances.....	5,000. 00
Chagres division—	
Dredge and outfit.....	150,000. 00
Launch.....	5,000. 00
Gatun locks—	
Power plant	432,010. 00
Pumping plant.....	30,000. 00
Forms.....	90,000. 00
16-inch sand-suction dredge	35,000. 00
Seagoing tug.....	75,000. 00
Buildings, wharves, tracks, etc., Porto Bello.....	40,000. 00
Gatun dam—	
Hydraulic sluicing plant.....	35,000. 00
Discharge pipe, pontoons, and hose connection.....	29,500. 00
La Boca locks—	
Concrete work and approach walls at north end of lock.....	663,588. 00
Power plant	110,000. 00
La Boca dam—	
Rock fills for toes of dam	90,055. 00
Trestles at toes of dam	60,045. 00
Steam tug	75,000. 00
Concrete mixers and conveyors	20,000. 00
Buildings	
Marine barracks	10,500. 00
General offices	17,500. 00
30 4 family houses, at \$6,067.05	182,011. 50
16 24 room dormitories, at \$9,720.15	155,522. 40
12 cottages, at \$2,073.43	24,881. 16
13 houses, at \$5,198.84	67,584. 94
84 standard laborers' buildings, at \$2,380.95	200,000. 00
Shops	87,000. 00
Hotels and mess houses	50,000. 00
Store houses	70,000. 00
Division office buildings	35,000. 00
Miscellaneous buildings	150,000. 00
Furniture	115,000. 00
Animals, cages and mules	25,300. 00
Vehicles, wagons, trucks, carts, et	9,815. 00
Mechanical department	
New equipment and repairs, rolling stock, excavating	
equipment, ship machinery, shops, and electric-light	
plants	1,742,100. 00
Materials, tools, and supplies	
Office	36,960. 00
Excavations	12,025. 00
Printing	6,700. 00
Tools	225,500. 00
Tools, excavating, mining and track department	25,500. 00
Supplies, excavation, mining and track department	547,800. 00

New equipment—Continued.

Materials, tools, and supplies—Continued.

Fuel	\$1,301,950.00
Explosives	1,981,800.00
Rails and fastenings	273,095.00
Frogs and switches	26,249.00
Ties	122,500.00
Piling	275,000.00
Bridge timber	48,000.00
Cement	439,090.00
Pipe and fittings	83,000.00
Bricks, lumber, paints, oils, and miscellaneous supplies ..	499,318.00

Marine department—

For floating equipment (other than fuel) ..	76,900.00
Subsistence ..	29,800.00
Shops ..	21,000.00
Forage 750 animals	99,899.50
Blacksmith ..	2,396.00
Harness and shop material	12,853.50
Stable utensils ..	753.00
Veterinary medicines and instruments ..	1,000.00

Repairs

Floating equipment	122,500.00
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Buildings—

General office buildings ..	15,000.00
Quarters	235,000.00
Shops ..	7,000.00
Hotels	25,000.00
Division office buildings	20,000.00
Miscellaneous buildings	18,500.00
Corrals	1,500.00
Compressor plants	5,000.00
Electric-light plants	2,000.00
Storehouses	50,000.00

Miscellaneous ..	170,700.00
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Traveling expenses of inspectors, officers, and special agents, including salaries and services ..	44,000.00
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Total item 5 ..	11,752,708.00
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ITEM 6.

To continue the equipment and construction of the Panama Railroad, to be disbursed directly under the Isthmian Canal Commission, \$1,750,000, no part of said sum shall be expended until the obligation of the Panama Railroad Company for the full amount thereof and drawing 4 per cent interest payable to the United States shall have been delivered to the Secretary of the Treasury of the United States and by him accepted.....

\$1,750,000.00

	Material.	Labor.	Total.
Grading	\$75,000.00	\$645,000.00	\$720,000.00
Temporary trestles	150,000.00	100,000.00	250,000.00
Tunnel	20,000.00	10,000.00	30,000.00
Temporary tracks	100,000.00	50,000.00	150,000.00
Permanent tracks	150,000.00	50,000.00	200,000.00
Ballast	10,000.00	40,000.00	50,000.00
Fencing	6,000.00	4,000.00	10,000.00
Telegraph and telephones	25,000.00	20,000.00	45,000.00
Depots	6,000.00	4,000.00	10,000.00
Water stations	6,000.00	4,000.00	10,000.00
Fuel stations	12,000.00	8,000.00	20,000.00
Miscellaneous structures ..	5,000.00	5,000.00	10,000.00
General expenses	10,000.00	50,000.00	60,000.00
Plant	100,000.00	10,000.00	110,000.00
Engineering		75,000.00	75,000.00
Total item 6 ..	675,000.00	1,075,000.00	1,750,000.00

SUPPLEMENTAL ESTIMATE.

For equipment of Panama Railroad.....	\$1, 213, 940. 00
8 refrigerator cars.....	40, 000. 00
4 first-class coaches.....	33, 440. 00
4 second-class coaches.....	26, 400. 00
5 baggage and mail cars (2 specie).....	27, 500. 00
200 80,000-pound box cars ..	200, 000. 00
6 caboose cars.....	6, 600. 00
2 coal lighters.....	20, 000. 00
Dock (permanent), capacity 3 600-foot ships.	700, 000. 00
Coal-handling plant.....	60, 000. 00
New quarters for employees.....	100, 000. 00

Total supplemental item No. 6..... 1, 213, 940. 00

ITEM 7.

For miscellaneous expenditures, cable and telegraph service, stationery and printing, and traveling and incidental expenses on the Isthmus for the departments of construction and engineering, disbursing, examination of accounts, and labor, quarters and subsistence..... \$456, 430. 00

Construction and engineering department:

Local transportation.....	\$156, 000. 00
Extra train service.....	5, 000. 00
Telegraph and cables.....	5, 000. 00
Travel on the Isthmus.....	15, 330. 00
Stationery and printing.....	7, 100. 00
Incidental expenditures	8, 000. 00

196, 430. 00

Disbursement department

Transportation of currency to the Isthmus.....	15, 000. 00
Miscellaneous expenditures, including special pay trains	10, 000. 00

25, 000. 00

Labor, quarters, and subsistence department

Transportation and recruiting—	
4 000 West Indians at \$15.....	60, 000. 00
3 075 Europeans at \$40	123, 000. 00
800 gold men at \$20	16, 000. 00
Local transportation	2 000. 00
Repatriation	24, 000. 00
Stationery, printing, and incidental expenditures ..	10, 000. 00

235, 000. 00

Total item 7..... 456, 430. 00

ITEM 8

For pay of officers and employees other than skilled and unskilled labor in the service of the government of the Canal Zone..... \$496, 160. 00

Head of department—Commissioner

14 000. 00

Executive staff:

Executive secretary at \$4 000.....	4, 000. 00
Chief clerk at \$2 400.....	2 400. 00
2 clerks at \$2 400.....	4 800. 00
4 clerks at \$1 800.....	7 200. 00
6 clerks at \$1 500.....	9 000. 00
1 translator at \$1 800.....	1 800. 00
1 messinger at \$20	720. 00
2 messengers at \$30	720. 00

Division of public works

Superintendent of public works at \$4 000.....	4 000. 00
Chief plumbing inspector at \$2 400.....	2 400. 00
5 water inspectors for Zone, at \$1,500.....	7 500. 00

Division of public works—Continued.

Chief clerk, at \$1,800.....	\$1, 800. 00
Clerk, at \$1,500.....	1, 500. 00
Clerk, at \$900.....	900. 00
Messenger, at \$450.....	450. 00
Messenger, at \$300.....	300. 00
Supervisor, at \$2,400.....	2, 400. 00
2 cashiers and accountants, at \$1,800.....	3, 600. 00
2 plumbing inspectors, at \$1,980.....	3, 960. 00
2 general foremen, at \$1,800.....	3, 600. 00
Engineer, at \$2,100.....	2, 100. 00
Clerk and interpreter, at \$1,200.....	1, 200. 00
Watchman, at \$1,200.....	1, 200. 00

Fire department:

Chief, at \$2,500.....	2, 500. 00
Assistant chief, at \$1,800.....	1, 800. 00
6 captains, at \$1,800.....	10, 800. 00
6 lieutenants, at \$1,620.....	9, 720. 00
Chief clerk, at \$2,100.....	2, 100. 00
Clerk, at \$1,500.....	1, 500. 00
Messenger, at \$360.....	360. 00

Prosecuting attorney's office:

Prosecuting attorney, at \$3,600.....	3, 600. 00
Assistant prosecuting attorney, at \$2,400.....	2, 400. 00
Clerk, at \$1,800.....	1, 800. 00

Judiciary:

Chief justice supreme court and circuit court, at \$6,500.....	6, 500. 00
2 associate justices supreme court and circuit judges, at \$6,000.....	12, 000. 00
1 supreme court clerk, at \$3,000.....	3, 000. 00
3 circuit court clerks, at \$2,100.....	6, 300. 00
3 circuit court interpreters, at \$1,800.....	5, 400. 00
3 circuit court messengers, at \$360.....	1, 080. 00
2 circuit court janitors, at \$360.....	720. 00
1 district court judge, at \$2,750.....	2, 750. 00
4 district court judges, at \$2,400.....	9, 600. 00
Clerical assistance for district judges.....	1, 200. 00

Police department:

Chief, at \$4,000.....	4, 000. 00
First lieutenant, at \$2,000.....	2, 000. 00
Second lieutenant, at \$1,800.....	1, 800. 00
Chief clerk, at \$2,100.....	2, 100. 00
2 clerks, at \$1,800.....	3, 600. 00
4 clerks, at \$1,500.....	6, 000. 00
16 sergeants, at \$1,500.....	24, 000. 00
20 corporals, at \$1,320.....	26, 400. 00
100 first-class policemen, at \$1,200.....	120, 000. 00
75 second-class policemen, at \$480.....	36, 000. 00

Department of revenues:

Collector of revenues, at \$5,000.....	5, 000. 00
1 deputy collector of revenues, at \$2,400.....	2, 400. 00
1 deputy collector of revenues, at \$2,100.....	2, 100. 00
2 clerks, at \$2,100.....	4, 200. 00
6 clerks, at \$1,800.....	10, 800. 00
10 clerks, at \$1,500.....	15, 000. 00
1 storekeeper, at \$1,800.....	1, 800. 00
1 inspector of customs, at \$1,800.....	1, 800. 00
2 inspectors of customs, at \$1,500.....	3, 000. 00
2 land agents, at \$1,500.....	3, 000. 00
2 bookkeepers, at \$1,200.....	2, 400. 00
3 copyists, at \$900.....	2, 700. 00
3 messengers, at \$360.....	1, 080. 00
Collection of taxes—	
4 district collectors, at \$2,100.....	8, 400. 00
4 inspectors, at \$1,500.....	6, 000. 00
4 clerks, at \$1,200.....	4, 800. 00
4 copyists, at \$900.....	3, 600. 00

Department of revenues—Continued

Postal division—

1 postmaster, at \$2,600.....	\$2,600.00
2 postmasters, at \$2,400.....	4,800.00
2 postmasters, at \$2,100.....	4,200.00
3 postmasters, at \$1,800.....	5,400.00
6 postmasters, at \$1,650.....	9,900.00
4 postmasters, at \$1,500.....	6,000.00
5 assistant postmasters, at \$1,600.....	8,000.00
23 postal clerks, at \$1,500.....	34,500.00
10 postal clerks, at \$1,200.....	12,000.00
1 copyist, at \$900.....	900.00
5 railway messengers, at \$1,000.....	5,000.00
1 post-office messenger, at \$720.....	720.00
14 post-office messengers, at \$450.....	6,300.00
3 post-office messengers, at \$360.....	1,080.00
Total.....	179,480.00
Less estimated revenues from postal service.....	75,000.00
	104,480.00
Total item 8.....	496,460.00

ITEM 9.

For skilled and unskilled labor in the service of the government of the Canal Zone..... **\$73,360.00**

Division of public works:

4 engineers, at \$1,200.....	4,800.00
6 firemen, at \$600.....	3,600.00
Unskilled labor, at \$12,000.....	12,000.00

Fire department:

Engineer, at \$1,800.....	1,800.00
Electrician, at \$1,800.....	1,800.00
30 firemen, at \$1,500.....	45,000.00
Extra pay to volunteers estimated at 4,000 hours, \$1.....	4,000.00

Police department

Janitor, at \$360.....	360.00
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Total item 9..... 73,360.00

ITEM 10

For material, supplies, equipment, new buildings, and contingent expenses for account of the government of the Canal Zone..... **\$118,500.00**

Executive office

Office supplies.....	\$2,000
Traveling miscellaneous, and contingent expenses.....	1,000
	3,000.00

Division of public works

Material and supplies for water and sewer operation and repairs and paying repairs Panama and Colon.....	18,000
Office furniture and supplies.....	1,000
Traveling miscellaneous and contingent expenses.....	3,000
	22,000.00

Fire department

Office supplies.....	500
Equipment and supplies for apparatus including chemical extinguishers for distribution.....	10,000
Forage.....	3,000
Traveling miscellaneous and contingent expenses.....	1,000
	14,500.00

Prosecuting attorney's office:		
Books and office supplies	\$500	
Traveling, miscellaneous, and contingent expenses.....	500	
		\$1, 000. 00
Judiciary:		
Books, printing, and office supplies.....	1, 000	
Traveling, miscellaneous, and contingent expenses.....	1, 000	
		2, 000. 00
Police department		
Stationery, printing, and office supplies	3, 500	
Horses, arms, and accouterments	8, 000	
Forage	5, 000	
Maintenance of prisoners.. . . .	9, 000	
Traveling, miscellaneous, and contingent expenses ...	10, 000	
		35, 500. 00
Postal division:		
Stationery, printing, and office supplies ...	13, 000	
Transportation of mails.....	25, 000	
Traveling, miscellaneous, and contingent expenses.....	2, 500	
		40, 500. 00
Total item 10.....		118, 500. 00

ITEM 11.

For pay of officers and employees, other than skilled and unskilled labor,
engaged in the sanitation department on the Isthmus..... \$764, 786. 00

Office of chief sanitary officer:		
1 chief sanitary officer (Commissioner) \$10,000.....	10, 000. 00	
1 executive officer, at \$5,200.....	5, 200. 00	
1 general inspector, at \$3,300.....	3, 300. 00	
1 chief clerk, at \$2,400.	2, 400. 00	
3 clerks, class D, at \$2,100.....	6, 300. 00	
7 clerks, class C, at \$1,800.....	12, 600. 00	
18 clerks, class B, at \$1,500.....	27, 000. 00	
1 vaccinator, at \$1,500.....	1, 500. 00	
1 watchman, at \$600.....	600. 00	
2 messengers, at \$600.....	1, 200. 00	
2 messengers, at \$360.....	720. 00	
Property division:		
1 storekeeper, at \$2,100.....	2, 100. 00	
1 storekeeper, at \$1,800.....	1, 800. 00	
3 clerks, at \$1,500.....	4, 500. 00	
3 watchmen, at \$600.....	1, 800. 00	
Quarantine service:		
1 chief quarantine officer, at \$7,000.....	7, 000. 00	
2 quarantine officers, at \$3,500.....	7, 000. 00	
1 assistant quarantine officer, Colon, at \$2,400.....	2, 400. 00	
1 clerk and stenographer, at \$1,800.....	1, 800. 00	
1 custodian also serving as disinfecter), at \$1,500.....	1, 500. 00	
1 quartermaster and disinfecter, at \$1,500.....	1, 500. 00	
1 clerk and custodian, Colon, at \$1,500.....	1, 500. 00	
1 quartermaster, Panama, at \$1,200.....	1, 200. 00	
2 matrons, at \$300.....	600. 00	
4 watchmen, at \$300.....	1, 200. 00	
Ancon Hospital.		
1 superintendent, at \$7,000.....	7, 000. 00	
1 executive officer, at \$3,300.....	3, 300. 00	
1 chief surgical clinic, at \$4,500.....	4, 500. 00	
1 chief medical clinic, at \$4,500.....	4, 500. 00	
1 oculist and aurist, at \$4,500.....	4, 500. 00	
2 physicians, at \$3,000	6, 000. 00	
3 physicians, at \$2,400.....	7, 200. 00	
8 physicians, at \$1,800.....	14, 400. 00	
1 alienist, at \$3,000.....	3, 000. 00	
1 chief clerk, at \$2,100.....	2, 100. 00	
1 clerk, at \$1,800.....	1, 800. 00	
2 clerks, at \$1,500.....	3, 000. 00	

Ancon Hospital—Continued.

1 clerk, at \$1,800	\$1,800 00
1 druggist, at \$1,800	1,800 00
1 assistant druggist, at \$1,500	1,500 00
1 superintendent of nurses, at \$1,800	1,800 00
1 assistant superintendent of nurses, at \$1,500	1,500 00
1 operating-room nurse, at \$1,200	1,200 00
1 dietist, at \$1,200	1,200 00
33 nurses, at \$900	\$1,500 00
35 nurses, at \$720	25,200 00
1 matron, insane, at \$900	900 00
1 chaplain, at \$1,200	1,200 00
1 visiting chaplain, at \$480	480 00
1 commissary, at \$1,800	1,800 00
1 quartermaster, at \$1,500	1,500 00
1 storekeeper, at \$1,800	1,800 00
1 superintendent of laundry, \$2,100	2,100 00
1 assistant superintendent of laundry, \$1,500	1,500 00
1 embalmer, at \$1,500	1,500 00
4 nurses, male, at \$720	2,880 00
4 nurses, male, at \$900	3,600 00

Laboratory

1 chief of laboratory, at \$4,000	4,000 00
1 pathologist, at \$3,000	3,000 00
1 chemist, at \$3,000	3,000 00
1 bacteriologist at \$3,000	3,000 00
2 laboratory attendants, at \$1,020	2,040 00
1 attendant, at \$540	540 00
11 attendants, at \$360	3,960 00
21 attendants, at \$300	6,300 00
1 assistant druggist, at \$900	900 00
2 telephone operators, at \$300	600 00
3 subforemen, at \$450	1,350 00
1 gardener, at \$360	360 00
1 gardener, at \$300	300 00
1 messenger, at \$180	180 00
2 messengers, at \$120	252 00
1 janitor, at \$600	600 00

On 10/10/2011, the following was received:

Q. No.	Q. Text	Ans.
1	1. The first part of the question is about the definition of a function. A function is a relation between a set of inputs and a set of possible outputs, where each input is related to exactly one output.	1.00 (0)
2	2. The second part of the question is about the domain and range of a function. The domain is the set of all possible inputs, and the range is the set of all possible outputs.	2.00 (0)
3	3. The third part of the question is about the graph of a function. The graph is a visual representation of the function, showing the relationship between the input and output values.	3.00 (0)
4	4. The fourth part of the question is about the properties of a function. A function can be one-to-one, many-to-one, or many-to-many.	4.00 (0)
5	5. The fifth part of the question is about the composition of functions. The composition of two functions is a new function that is formed by applying one function to the output of the other.	5.00 (0)
6	6. The sixth part of the question is about the inverse of a function. The inverse of a function is a function that reverses the mapping of the original function.	6.00 (0)
7	7. The seventh part of the question is about the continuity of a function. A function is continuous if it has no jumps or breaks in its graph.	7.00 (0)
8	8. The eighth part of the question is about the differentiability of a function. A function is differentiable if it has a unique tangent line at every point on its graph.	8.00 (0)
9	9. The ninth part of the question is about the extrema of a function. The extrema are the maximum and minimum values of a function.	9.00 (0)
10	10. The tenth part of the question is about the asymptotes of a function. The asymptotes are lines that the graph of a function approaches as the input or output values approach infinity.	10.00 (0)

6. 11. 1941

[illegible]

Colon Hospital—Continued.

2 chaplains, at \$1,200.....	\$2,400.00
10 attendants, at \$360.....	3,600.00
30 attendants, at \$300.....	9,000.00
4 messengers, at \$216.....	864.00
2 watchmen, at \$360.....	720.00
1 foreman, at \$900.....	900.00
1 subforeman, at \$600.....	600.00

Taboga Sanitarium:

1 superintendant (physician), at \$3,000.....	3,000.00
1 chief nurse, at \$1,200.....	1,200.00
1 nurse, at \$900.....	900.00
1 nurse, at \$720.....	720.00
1 storekeeper and clerk, at \$1,500.....	1,500.00
1 mechanical foreman, at \$1,500.....	1,500.00
4 attendants, at \$300.....	1,200.00
1 watchman, at \$360.....	360.00
1 attendant, at \$360.....	360.00

Palo Seco Leper Asylum:

1 superintendant, at \$1,800.....	1,800.00
1 nurse, at \$1,200.....	1,200.00
4 attendants, at \$480.....	1,920.00

La Boca Dispensary:

1 physician, at \$2,400.....	2,400.00
1 clerk and dispenser, at \$900.....	900.00
1 dispenser of quinine, at \$720.....	720.00
1 dispenser in sick camp, at \$360.....	360.00
1 attendant, at \$360.....	360.00

Tivoli district and Panama Dispensary:

1 physician, at \$2,400.....	2,400.00
1 clerk and dispenser, at \$900.....	900.00
1 dispenser of quinine, at \$720.....	720.00
1 attendant, at \$360.....	360.00

Corozal Dispensary:

1 physician, at \$2,400.....	2,400.00
1 clerk and dispenser, at \$900.....	900.00
1 dispenser of quinine, at \$600.....	600.00
1 attendant, at \$360.....	360.00

Pedro Miguel Dispensary:

1 physician, at \$2,400.....	2,400.00
1 clerk and dispenser, at \$900.....	900.00
1 dispenser of quinine, at \$600.....	600.00
1 dispenser in sick camp, at \$360.....	360.00
1 attendant, at \$300.....	300.00

Paraiso Hospital:

1 physician, at \$3,000.....	3,000.00
1 physician, at \$1,800.....	1,800.00
1 clerk, at \$1,500.....	1,500.00
1 nurse, at \$900.....	900.00
1 dispenser of quinine, at \$720.....	720.00
1 dispenser, white sick camp, at \$600.....	600.00
1 dispenser for colored sick camp, at \$360.....	360.00
2 attendants, at \$360.....	720.00
1 attendant (Cucuracha), sick camp, at \$360.....	360.00

Culebra Hospital:

1 physician, at \$3,600.....	3,600.00
1 physician, at \$3,000.....	3,000.00
1 physician, at \$2,400.....	2,400.00
2 physicians, at \$1,800.....	3,600.00
1 ophthalmic and aural surgeon, at \$1,800.....	1,800.00
1 clerk, at \$1,800.....	1,800.00
1 druggist, at \$1,200.....	1,200.00
1 chief nurse, at \$1,200.....	1,200.00
2 nurses, at \$900.....	1,800.00
2 dispensers of quinine, at \$720.....	1,440.00
1 chaplain, at \$1,200.....	1,200.00
2 attendants, at \$360.....	720.00
2 attendants, at \$300.....	600.00

Empire Hospital:

1 physician, at \$3,000.....	\$3,000.00
1 physician, at \$2,400.....	2,400.00
1 physician, at \$1,800.....	1,800.00
1 clerk, at \$1,500.....	1,500.00
1 druggist, at \$720.....	720.00
1 nurse, at \$900.....	900.00
1 dispenser of quinine, at \$720.....	720.00
1 dispenser, sick camp, white, at \$600.....	600.00
1 attendant, at \$300.....	300.00
2 attendants, at \$180.....	360.00

Las Cascadas Hospital:

1 physician, at \$3,000.....	3,000.00
1 physician, at \$1,800.....	1,800.00
1 clerk, at \$1,500.....	1,500.00
1 druggist, at \$600.....	600.00
1 dispenser of quinine, at \$600.....	600.00
1 nurse, at \$900.....	900.00
1 attendant, at \$360.....	360.00
2 attendants, at \$300.....	600.00

Bas Obispo Hospital:

1 physician, at \$3,000.....	3,000.00
1 physician, at \$2,400.....	2,400.00
1 physician, at \$1,800.....	1,800.00
1 clerk, at \$1,500.....	1,500.00
1 druggist, at \$600.....	600.00
1 nurse, Santa Cruz Camp, at \$900.....	900.00
1 nurse, at \$720.....	720.00
1 dispenser of quinine, at \$600.....	600.00
1 attendant, at \$360.....	360.00
3 attendants, at \$300.....	900.00

Gorgona Hospital:

1 physician, at \$3,000.....	3,000.00
1 physician, at \$2,400.....	2,400.00
1 physician, at \$1,800.....	1,800.00
1 clerk, at \$1,500.....	1,500.00
1 druggist, at \$720.....	720.00
2 nurses (Mamei) at \$900.....	1,800.00
1 nurse Bas Matachin shops, at \$900.....	900.00
1 dispenser of quinine, at \$600.....	600.00
1 chaplain, at \$1,200.....	1,200.00
1 attendant Mamei, at \$480.....	480.00
2 attendants, at \$360.....	720.00
1 attendant, at \$300.....	300.00

Talernilla Dispensary

1 physician, at \$2,400.....	2,400.00
1 physician, at \$1,800.....	1,800.00
1 clerk and dispenser, at \$900.....	900.00
1 dispenser of quinine, at \$600.....	600.00
1 dispenser, colored sick camp, at \$360.....	360.00
1 attendant, white sick camp, at \$480.....	480.00
1 attendant, colored sick camp, at \$360.....	360.00

Gatun Hospital

1 physician, at \$3,000.....	3,000.00
2 physicians, at \$1,800.....	3,600.00
1 clerk, at \$1,500.....	1,500.00
1 druggist, at \$720.....	720.00
1 dispenser of quinine, at \$600.....	600.00
1 nurse, at \$900.....	900.00
1 nurse, at \$720.....	720.00
1 sick camp dispenser, at \$360.....	360.00
2 attendants, at \$360.....	720.00
1 attendant, at \$300.....	300.00

Cristobal Dispensary

1 physician, at \$3,000.....	3,000.00
2 physicians, at \$1,800.....	3,600.00
1 clerk and dispenser, at \$900.....	900.00

Cristobal Dispensary—Continued.

1 druggist, at \$600.....	\$600.00
1 dispenser at sick camp, at \$360.....	360.00
Railroad construction camps:	
1 physician, at \$1,800.....	1,800.00
1 nurse, at \$900.....	900.00
1 dispenser, sick camps, at \$360.....	360.00
1 attendant, at \$360.....	360.00
Porto Bello quarry camp:	
1 physician, at \$1,800.....	1,800.00
1 nurse, at \$900.....	900.00
2 attendants, at \$360.....	720.00
Miraflores Dispensary.....	
1 physician, at \$1,800.....	1,800.00
1 clerk and dispenser, at \$900.....	900.00
1 dispenser of quinine, at \$720.....	720.00
1 attendant, at \$300.....	300.00
San Pablo Dispensary:	
1 physician, at \$1,800.....	1,800.00
1 clerk and dispenser, at \$900.....	900.00
1 dispenser of quinine, at \$720.....	720.00
1 attendant, at \$300.....	300.00
Santo Tomas Hospital:	
1 superintendent, at \$3,600.....	3,600.00
2 internes, at \$1,800.....	3,600.00
1 chief nurse, at \$1,200.....	1,200.00
2 nurses, at \$900.....	1,800.00
Extra positions and allowances for leaves of absence and sickness over and above the scheduled numbers of personnel asked for by the hospital division:	
2 physicians, at \$2,400.....	4,800.00
7 physicians, at \$1,800.....	12,600.00
1 clerk, at \$1,500.....	1,500.00
2 clerks and dispensers, at \$900.....	1,800.00
1 druggist, at \$1,200.....	1,200.00
3 dispensers of quinine, at \$720.....	2,160.00
5 male nurses, at \$720.....	3,600.00
1 chaplain, at \$480.....	480.00
1 chaplain, at \$1,200.....	1,200.00
Office of chief sanitary inspector:	
1 chief sanitary inspector, at \$3,600.....	3,600.00
1 assistant chief sanitary inspector, at \$2,400.....	2,400.00
3 district inspectors, at \$2,100.....	6,300.00
5 district inspectors, at \$1,800.....	9,000.00
7 sanitary inspectors, at \$1,500.....	10,500.00
6 sanitary foremen, at \$1,200.....	7,200.00
15 sanitary police, at \$900.....	13,500.00
1 chief clerk, Class A, at \$2,100.....	2,100.00
2 chief clerks, Class C, at \$1,800.....	3,600.00
2 clerks, Class B, at \$1,500.....	3,000.00
2 clerks, at \$900.....	1,800.00
2 foremen, at \$900.....	1,800.00
10 foremen, at \$720.....	7,200.00
5 foremen, at \$600.....	3,000.00
10 storekeepers, at \$600.....	6,000.00
15 subforemen, at \$450.....	6,750.00
Health office of Panama:	
Health officer at \$3,600.....	3,600.00
1 assistant health officer, at \$2,400.....	2,400.00
2 clerks, Class C, at \$1,800.....	3,600.00
1 assistant timekeeper \$1,200.....	1,200.00
1 record clerk, at \$1,200.....	1,200.00
1 storekeeper, Class A, at \$1,500.....	1,500.00
1 assistant storekeeper, at \$900.....	900.00
2 sanitary inspectors, at \$1,800.....	3,600.00
6 sanitary inspectors, at \$1,500.....	9,000.00

Health office of Panama—Continued.

1 sanitary inspector, at \$1,200.....	\$1, 200. 00
1 foreman carpenter, at \$1,620.....	1, 620 00
2 foremen, at \$900.....	1, 800 00
6 foremen, at \$900.....	5, 400 00
6 foremen, at \$600.....	3, 600. 00
8 subforemen, at \$450.....	3, 600. 00

Health office of Colon-Cristobal:

1 health officer, at \$3,600.....	3,600 00
1 health office physician, at \$2,400.....	2,400 00
1 chief clerk, Class A, at \$2,100.....	2,100 00
2 clerks, Class B, at \$1,500.....	3,000 00
2 sanitary inspectors, at \$1,800.....	3,600 00
2 sanitary inspectors, at \$1,500.....	3,000 00
1 sanitary foreman, at \$1,200.....	1,200 00
1 foreman carpenter, at \$1,620.....	1,620 00
2 medical inspectors, at \$1,500.....	3,000 00
7 foremen, at \$600.....	4,200 00
7 subforemen, at \$450.....	3,150 00

Total item 11.....	764,786.00
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ITEM 12.

For skilled and unskilled labor engaged in the sanitation department on the Isthmus of Panama.....	\$667, 008. 80
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Office of chief sanitary officer:

1 janitor, at \$600.....	600.00
3 assistant janitors, at \$300.....	900.00
Emergency sanitary work.....	32,280.00

Property division:

1 carpenter, at \$600.....	600.00
8 laborers, at \$300.....	2,400.00

Quarantine Service

1 engineer, at \$1,620.....	1, 620 00
1 assistant engineer, at \$600.....	600 00
1 launchman, at \$720.....	720 00
1 cook, Panama, at \$600.....	600 00
1 cook, Colon, at \$480.....	480 00
1 fireman and machinist, at \$480.....	480 00
8 sailors, at \$360.....	2, 880 00
1 assistant cook, at \$420.....	420 00
2 cooks' helpers, at \$360.....	720 00
6 waiters, at \$240.....	1, 440 00
2 chambermaids, at \$240.....	480 00
1 carpenter, at \$720.....	720 00
4 laborers, at \$500.....	1, 200 00
Extra labor in emergencies, \$500.....	500 00
Salary of non-employees secured while regular employees are on leave.....	850 00

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Laboratory—Continued.

12 laundresses, at \$270.....	\$3, 240. 00
5 laundresses, at \$240.....	1, 200. 00
4 laundresses, at \$210.....	840. 00
30 laundresses, at \$180.....	5, 400. 00
1 baker, at \$720.....	720. 00
1 baker, at \$540.....	540. 00
1 baker, at \$360.....	360. 00
11 waiters, at \$240.....	2, 640. 00
1 waiter, at \$360.....	360. 00
14 scullions, at \$240.....	3, 360. 00
1 fireman, at \$480.....	480. 00
1 janitor of morgue, at \$480.....	480. 00
2 cooks, at \$1,080.....	2, 160. 00
1 cook, at \$600.....	600. 00
2 cooks, at \$540.....	1, 080. 00
1 cook, at \$450.....	450. 00
1 cook, at \$360.....	360. 00
1 dairyman, at \$540.....	540. 00
2 dairymen, at \$300.....	600. 00
1 fireman (laundry), 20 cents hour, \$499.....	499. 00
1 carpenter, 32 cents hour, \$798.....	798. 00
2 painters, 25 cents hour, \$624.....	1, 248. 00
50 laborers, average 10 cents hour, \$240.....	12, 000. 00
Office of director of hospitals:	
1 engineer, at \$900.....	900. 00
1 fireman, at \$420.....	420. 00
2 sailors, at \$360.....	720. 00
Colon Hospital:	
1 chief cook, at \$1,200.....	1, 200. 00
1 head waiter, at \$450.....	450. 00
4 assistant cooks, at \$720.....	2, 880. 00
6 assistant cooks, at \$300.....	1, 800. 00
16 scullions, at \$180.....	2, 880. 00
15 waiters, at \$240.....	3, 600. 00
30 ward maids, at \$144.....	4, 320. 00
40 orderlies, at \$180.....	7, 200. 00
1 ambulance driver, at \$540.....	540. 00
3 stablemen, at \$300.....	900. 00
3 gatemen, at \$300.....	900. 00
6 scrubbers, at \$240.....	1, 440. 00
4 seamstresses, at \$240.....	960. 00
2 carpenters, at \$624.....	1, 248. 00
2 painters, at \$624.....	1, 248. 00
2 firemen, at \$300.....	600. 00
10 laborers, at \$324.48.....	3, 244. 80
10 laborers, at \$224.60.....	2, 246. 00
Taboga Sanitarium:	
1 cook, at \$600.....	600. 00
1 cook, at \$300.....	300. 00
6 orderlies, at \$180.....	1, 080. 00
1 laundress, at \$180.....	180. 00
4 skilled laborers, at \$768.....	3, 072. 00
Paraiso Hospital:	
2 orderlies, at \$240.....	480. 00
1 cook, at \$360.....	360. 00
1 laundress, at \$180.....	180. 00
Culebra Hospital:	
3 orderlies, at \$240.....	720. 00
7 orderlies, at \$180.....	1, 260. 00
1 ambulance driver, at \$480.....	480. 00
1 cook, at \$600.....	600. 00
1 assistant cook, at \$360.....	360. 00
Empire Hospital:	
1 orderly, at \$240.....	240. 00
2 orderlies, at \$180.....	360. 00
1 cook, at \$360.....	360. 00

Las Cascadas Hospital	
2 orderlies, at \$180	\$360 00
1 cook, at \$360	360 00
1 laundress, at \$180	180 00
2 orderlies, at \$240	480 00
San Obispo Hospital	
3 orderlies, at \$180	540 00
1 cook (hospital), at \$240	420 00
1 cook (white sick camp), at \$360	360 00
1 cook (colored sick camp), at \$300	300 00
1 laundress, at \$180	180 00
1 orderly, at \$240	240 00
Gorgona Hospital	
2 cooks, at \$360	720 00
1 orderly, at \$240	240 00
2 orderlies, at \$180	360 00
1 laundress, at \$180	180 00
1 laundress (Mattei), at \$72	72 00
Gatun Hospital	
1 cook, at \$420	420 00
2 orderlies, at \$240	480 00
2 orderlies, at \$180	360 00
Railroad construction camps	
1 orderly, at \$180	180 00
Porto Bello quarry camp	
2 orderlies, at \$240	480 00
Office of chief sanitary inspector:	
75 night soilmen, at \$384	28,800 00
4 masons and tilers, at \$624	2,496 00
15 masons and tilers, at \$499 20	7,488 00
10 masons and tilers, at \$798.72	7,987 20
10 carpenters, at \$624	6,240 00
30 carpenters, at \$492.20	14,976 00
30 carpenters, at \$339.36	11,980 80
250 laborers, at \$624	156,000 00
50 laborers, at \$449 20	24,960 00
150 laborers at \$312	140,400 00
25 water boys at \$218 40	5,460 00
Health office at Panama	
1 painter third grade, at \$600	600 00
1 carpenter third grade, at \$600	600 00
1 carpenter second grade at \$480	480 00
2 carpenters first grade, at \$384	768 00
3 laborers at \$351	1,053 00
129 laborers at \$270	32,400 00
1 laborer at \$189	189 00
Health office at Colon Cristobal	
3 carpenters at \$600	1,800 00
2 carpenters at \$480	960 00
3 carpenters at \$384	1,152 00
110 laborers at \$300	33,000 00
6 carpenters at \$384	2,304 00
88 laborers at \$384	3,379 20
Total for 1912	667,003 80

ITEM 13

For material, supplies, equipment, new buildings and contingent expenses for the sanitary and hospital department on the Isthmus	\$743,400 80
Cost of new buildings	123,000 00
Repairs to old buildings	50,000 00
Office furniture and supplies	5,000 00
Proportion of	800 00

Quarantine service:

Subsistence of personnel, including laborers and persons detained in quarantine at Panama and Colon.....	\$5,817.00
Fuel.....	801.00
Household furniture.....	1,828.00
Office furniture.....	180.00
Stationery and office supplies.....	540.00
Disinfecting supplies.....	3,479.00
Supplies for boats, including equipment.....	850.00
Miscellaneous supplies.....	1,675.00
Laundry.....	600.00
Miscellaneous.....	9,820.00

Ancon Hospital:

Storehouse supplies.....	30,000.00
Commissary supplies.....	90,000.00
Transportation.....	1,000.00
Electric current.....	10,752.00
Drugs and dressings.....	23,000.00

Hospital division:

Subsistence of personnel and patients.....	150,000.00
Equipment of new hospitals, and renewing equipment of old hospitals.....	29,499.50
Drugs and dressings.....	58,282.26
Miscellaneous, coal, lumber, lights, transportation, etc.....	41,693.44

Office of chief sanitary inspector:

Stationery and office supplies.....	1,000.00
Disinfectants.....	18,000.00
Lumber.....	5,555.60
Oils, mosquito-kerosene.....	20,000.00
Transportation, railroad, garbage, removal, etc.....	10,000.00
Miscellaneous, supplies, tools, etc.....	16,000.00

Health office of Panama:

Stationery and office supplies.....	1,000.00
Disinfectants.....	2,200.00
Lumber.....	600.00
Oils, mosquito-kerosene.....	3,500.00
Cart hire.....	9,390.00
Miscellaneous, supplies, tools, rope, etc.....	6,000.00

Health office of Colon-Cristobal:

Stationery and office supplies.....	500.00
Disinfectants.....	5,000.00
Lumber.....	1,000.00
Oils, mosquito-kerosene.....	1,500.00
Miscellaneous, tools, etc.....	3,538.00

Total item 13.....	743,400.80
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PANAMA RAILROAD
DISBURSING OFFICER ON
DEPARTMENT OF CIV
DEPARTMENT OF LAE



12

Page 6 of 10

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Inspectors
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HS Farish
G M Rowell

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Clifton
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Ancon
Panama
Senior
K Fails
3 Inspectors

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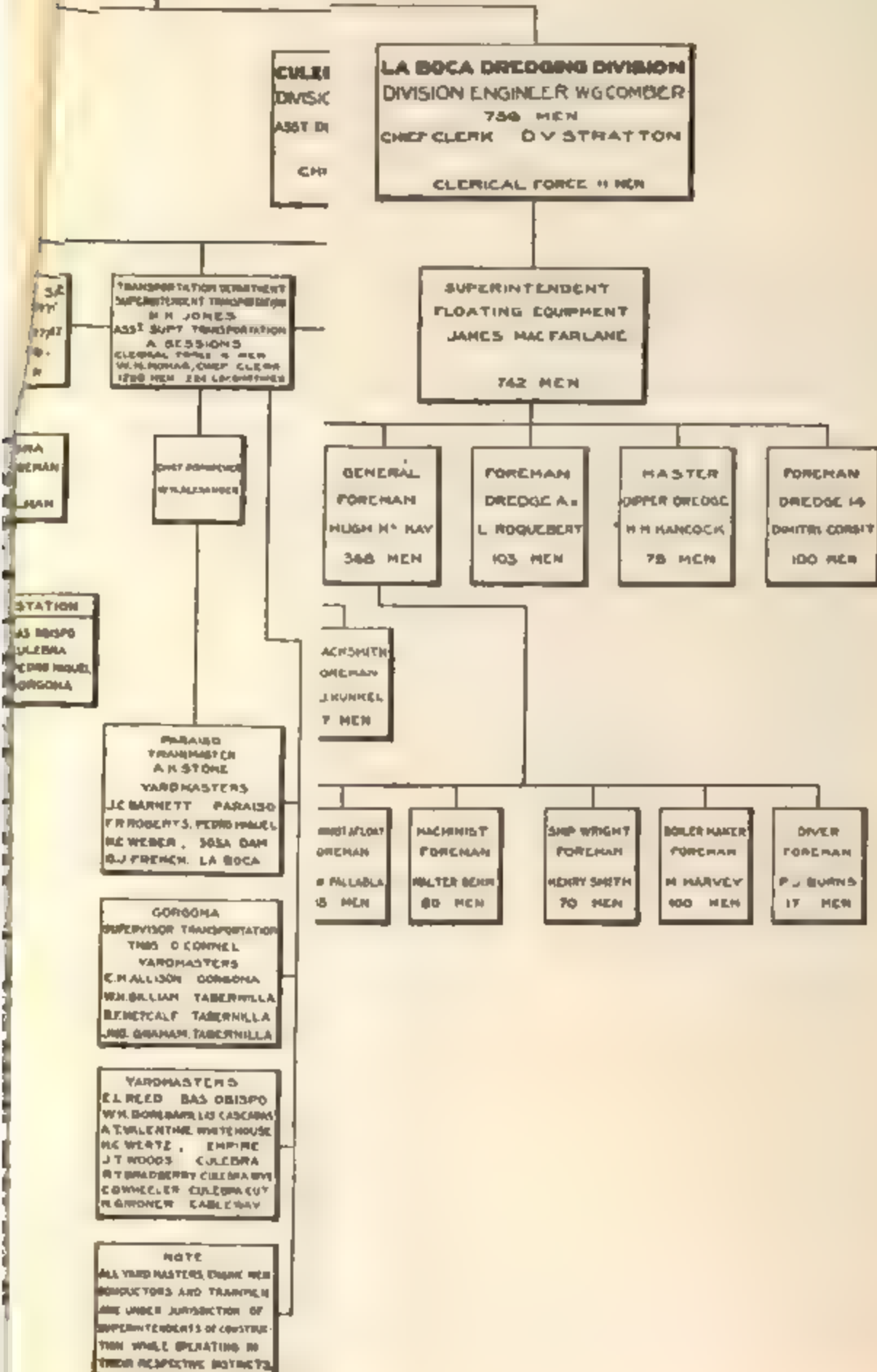
Paraisa
Pedro Miguel
Corozal
Senior
C W Boser
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Clerest R
B. G. H. H. H.
B. L. J. J. J.
Chief C.
1 C.



**MENT OF
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M.D. GAILLARD
ENGINEERS U.S.A.
M.D. COMMISSION
SECRETARY 12559 MEN**





MEN
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F COM
MEN.

CAL ANCTURAL DESIGN.
ALENG)esigning Engineers:
CHILDHAJENRYGOLDMARK, in Charge
Washington Office.
DAVID MOLITOR
MEN
5 MEN

DIVISION OF
TEOROLOGY AND RIVER HYDRAULICS
GARDO M ARANCO. DIV. ENGR.
49 MEN

Property
Clerk
LeMay
Men

Surveys & Borings
RESO. ENGIN.
A.C. Harper
10 Gold Men
73 Laborers

Measur
of Lines
R.P.W.
1 M

Chief Clerk
D.W.M. Carmack
5 Men

Principal
Hydrographer
Elliott
Men

Principal
Observer
F.D. Willson
8 Men

Transitman
J.A. Close
6 Gold Men
85 Laborers

La B
Drainag
Level
R.A.C.
6 Gold
76 Lab

NAOS ISLAND
Asst. Observer
J.H. JARBOE
1 BOATMAN

- LOWER CHAGRES DIST
25 MEN

Gatun
Box
Chas. B.
3 Bc

Trinidad Riv
Ass't Hydrographer
A. Bellejambe
2 Boatmen.

Bahio Station
Ass't Hydrographer
N. Mendez
2 Boatmen.

Hydrographer
J.A.
11

BASOBSPO
OBSERVATORY
Observer
D.R. Morris
E.W. KENNER

COLON
OBSERVATORY
OBSERVER
G.R. Oberholzer

TEOROLOGICAL SECTION
7 MEN.

Chief Clerk
L. May
F. Clerk
1 Men

Service
Edge
Landing
Reid
men
Men

LOCAL ENGINEER

ROBINSON.

MEN

LC - 212, P.R.

Williams

WILLIAMS

MAN

General Foreman

E.B. CAMPBELL

86 MEN

General F.

A.D. MOREY

34 MEN

Engineer

STORKE

MAN

Engine Plant

Radio Repair

to

Base Shop

85 MEN

Engine Plant

Cristobal

to

Base Shop

23 MEN

M.H.

ON

Shop

MAN

EN

Outside Gang

J.L. LITTLE

283 MEN

Paint Shop

R. EVEREST

14 MEN

Engine Plant

C. WILLIAMS

51 MEN

Shop

MAN

EN

Outside Gang

S. JACOB

88 MEN

Paint & Tin Shop

P. FARROW

40 MEN

Engine House

Low Concentration

W. HUGENT

78 MEN

Shop

MAN

EN

Outside Gang

C. PETERS

10 MEN

Paint Shop

E.P. CLARK

5 MEN

Steam Shop

Repair Gang

P.C. WASS

6 MEN

Shop

MAN

EN

Paint Shop

22 MEN

Pattern Shop

8 Dry House

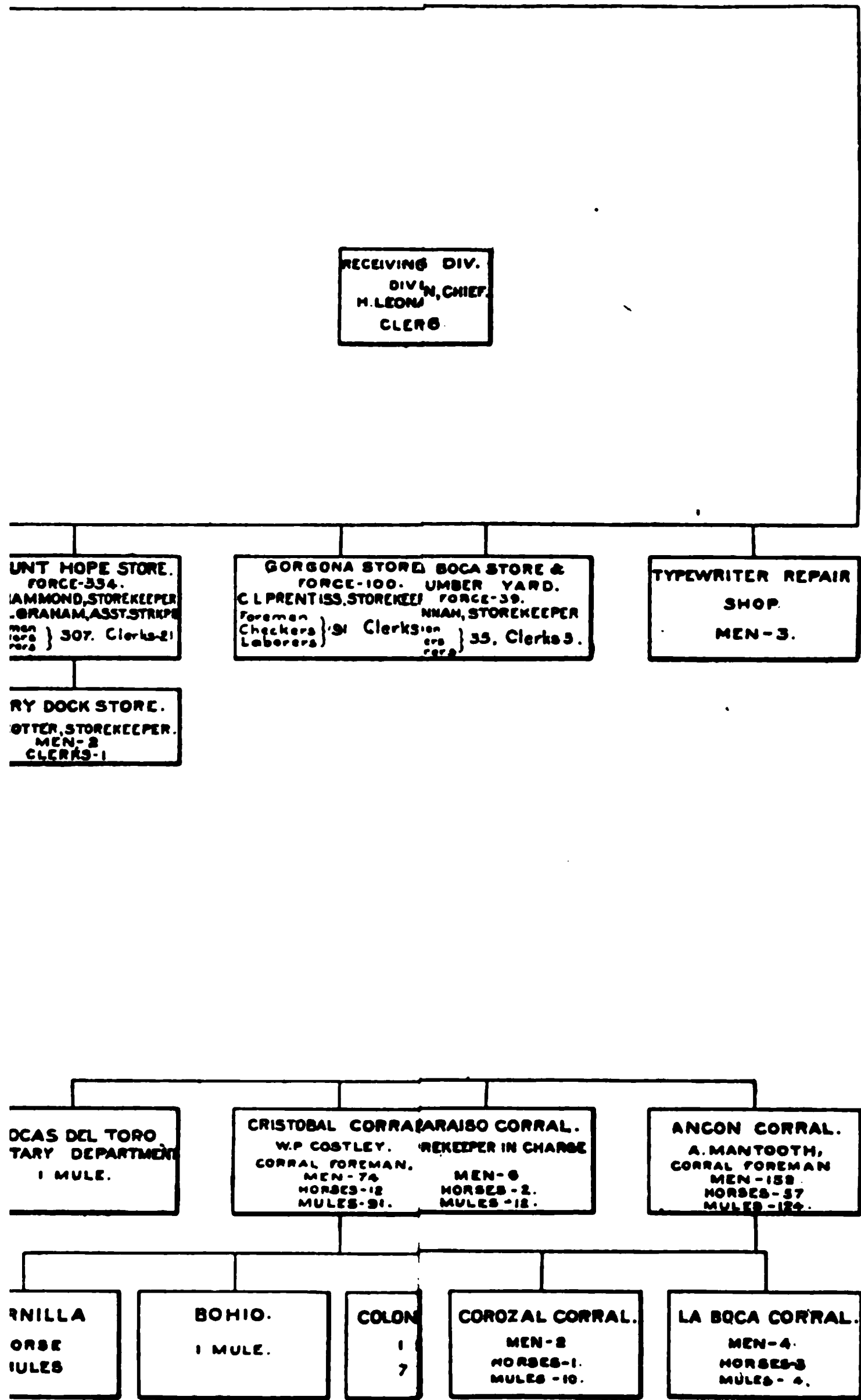
4 MEN

Shop

MAN

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NOV 1911

GORGONA
DIVISION
Employees
Gold 2
Silver 32
Total 34

AMERICAN
SETTLEMENT
HEAD
HOSPITAL

AMERICAN
SETTLEMENT
HEAD
NATIVE
TOWN

GORGONA
CAMP

NATIVE
GORGONA

JUAN
GRANDE

MAMEI

CABELLO
HILLO

SAN PABLO
DIVISION
Employees
Gold 1
Silver 35
Total 36

CAIMATO
MULATO

TABERNILLA
DIVISION
Employees
Gold 3
Silver 37
Total 40

AMERICAN
QUARTERS

LABORERS
OLD CAMP

LABORERS
NEW CAMP

WHITE
LABORERS
CAMP

NATIVE
VILLAGE

SAN LEY

BOHIO
DIVISION
Employees
Gold 1
Silver 22
Total 23

PRINCIPLES

NATIVE
VILLAGE

LION HILL

GATUN
DIVISION
Employees
Gold 5
Silver 60
Total 65

WHITE
MARRIED
QUARTERS

LABORERS
QUARTERS

WHITE
CAMP

COLORS
CAMP

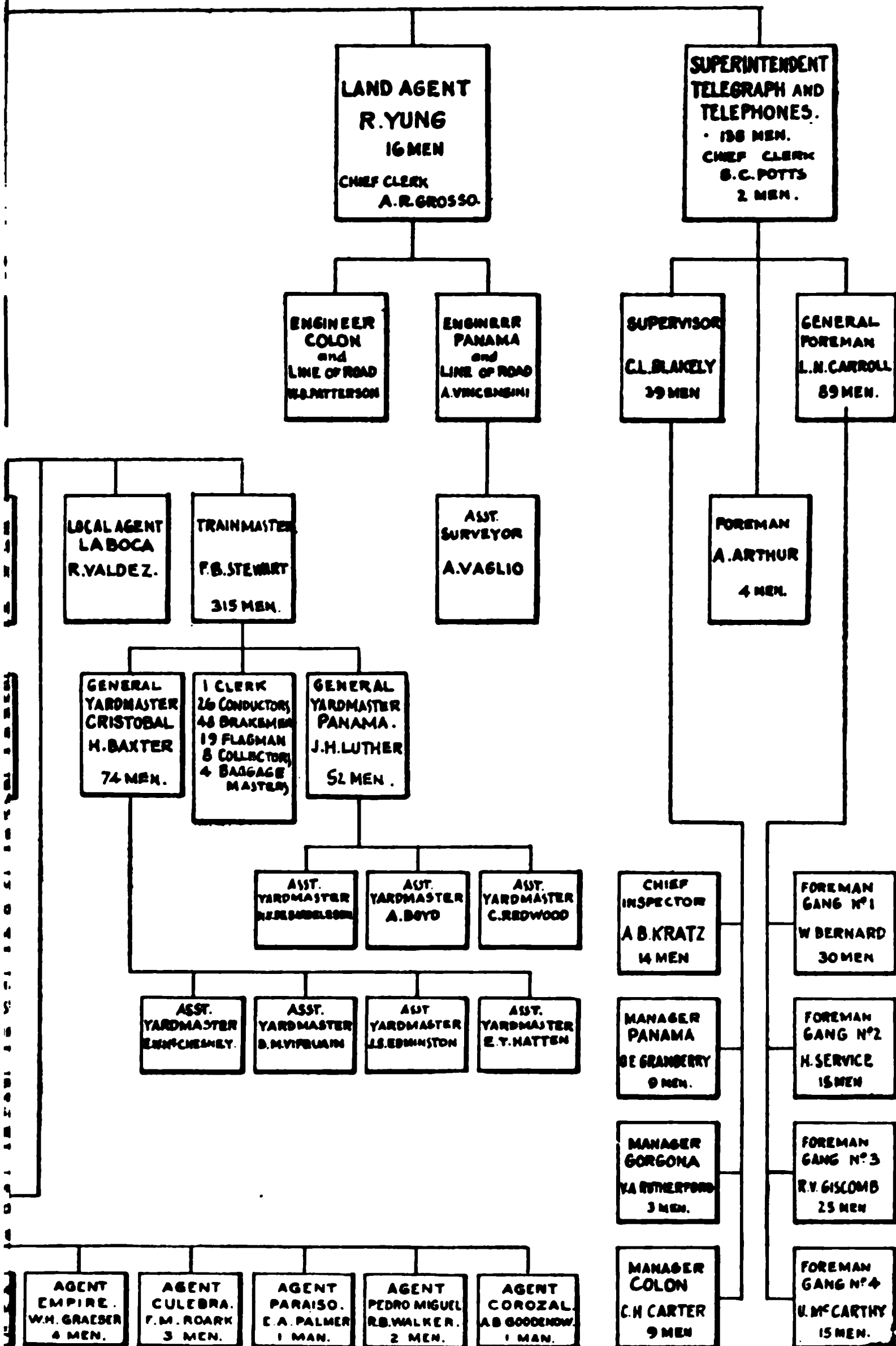
COLORS
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QUARTERS

NATIVE
TOWN

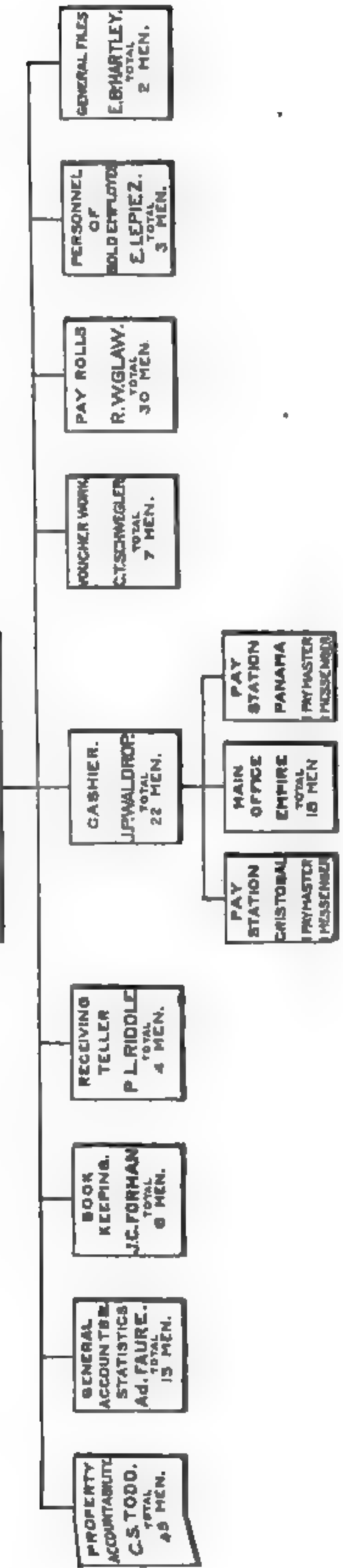
WHITE
PARTY

SPILLWAY





DISBURSING OFFICER ON THE Isthmus
AND TREASURER OF THE CANAL ZONE
Edward J. Williams.
TOTAL 141 MEN.
SECRETARY AND 1 MESSENGER.
CHIEF CLERK, W.M. WOOD, 3 MEN.

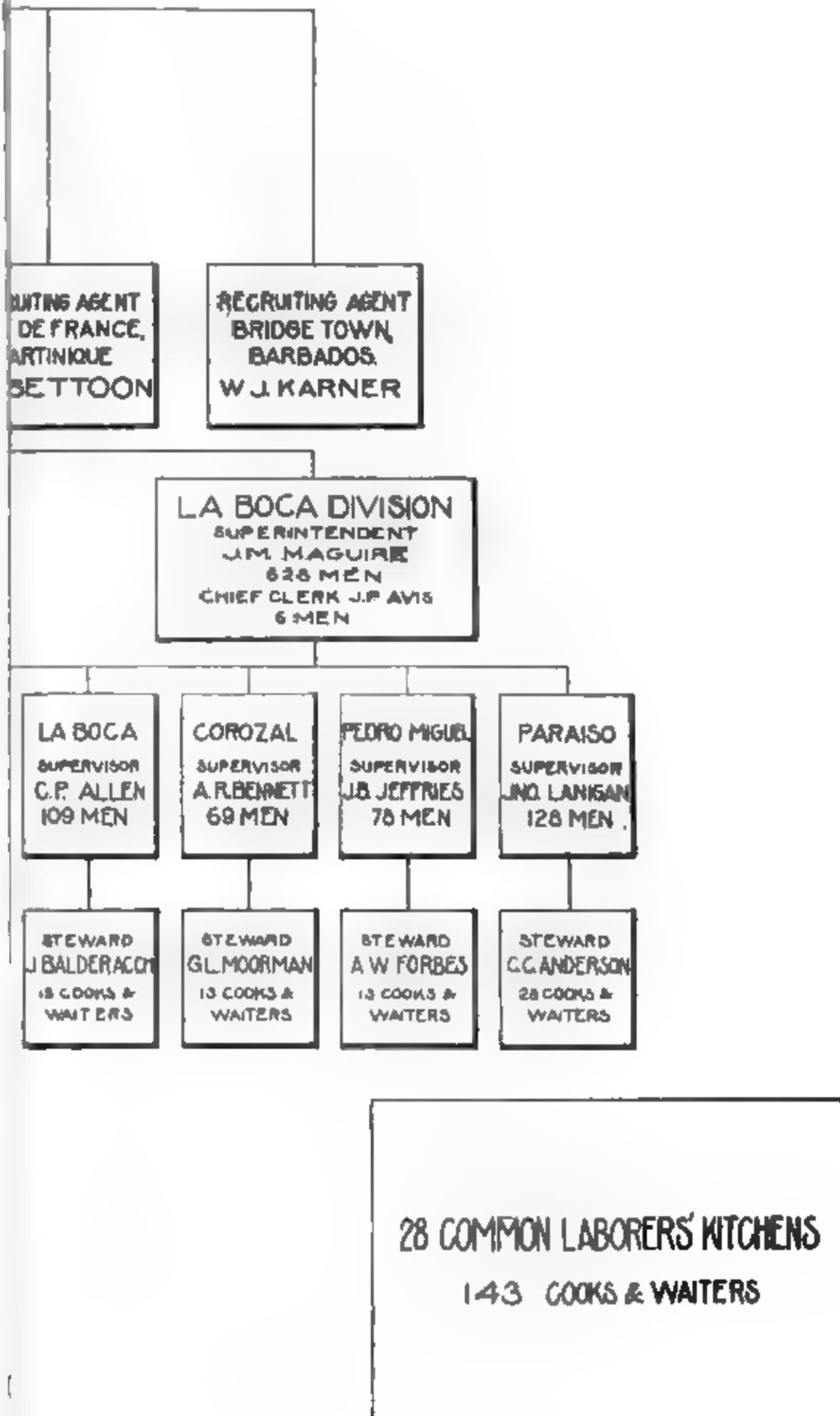


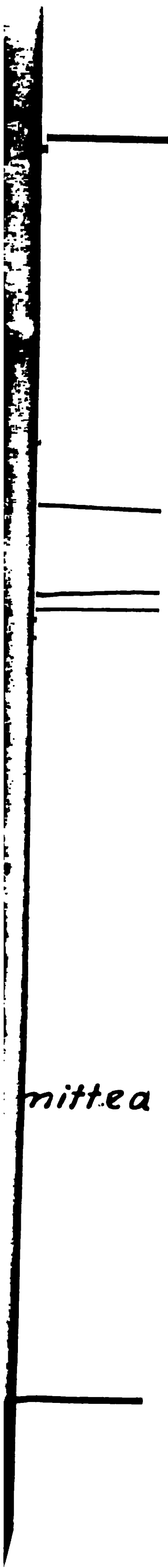
DEPARTMENT
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INTER
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